$1.00 the YEAR

ADVANCE NEW YORK SHOW NUMBER.

15 CEN[TS] the COPY

TH[redacted] MO[redacted]R TRUCK

Devot[redacted]Driven Business Vehicles of All Classes.

Vol. IV Pawtucket, R.I., January, 1913. No. 1

G. V. ELECTRIC TRUCKS AT THE NEW YORK SHOW

The General Vehicle Company, Inc., will have the largest space (A 38), and the largest exhibit in the Grand Central Palace section of the New York Auto Show, January 20th to 25th inclusive, and will exhibit the following:

1000 lb. Wagon, Zampieri Brothers, Bakers.
2000 " " Otto Stahl, Butcher.
2000 " Industrial Truck.
2-ton truck, Wells Fargo Express Co.
2-ton G. V. Chassis.
3 1-2 ton truck, Beadleston & Woerz, Brewers, (Panel side bottle truck)
5-ton " Jacob Ruppert, Brewer, (Screen side bottle truck)
5-ton " Jacob Ruppert, Brewer, (Low seat keg type)

These machines are all regular trucks and wagons going through the factory, but behind each one there is an interesting story.

Zampieri Brothers' little wagon represents a **horseless delivery system** for bakers. (All horses sold in 11 months, and 4 G. V. Wagons substituted). Otto Stahl has ordered 3 G. V's. in a year. The Wells Fargo Truck is something different in body lines and so is the Ruppert screen body truck.

Don't fail to see the G. V. Exhibit.

Catalogue 80 on request

THE GENERAL VEHICLE COMPANY, Inc.

Principal Office and Factory
LONG ISLAND CITY, N. Y.

NEW YORK CHICAGO MINNEAPOLIS BOSTON CINCINNATI PHILADELPHIA ST. LOUIS

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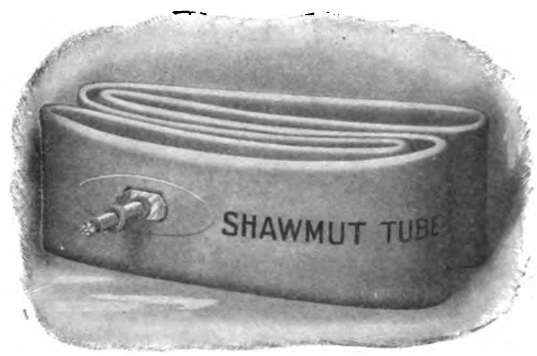

SHAWMUT TUBE

MOTOR TRUCK

Volume IV
Number I

Pawtucket
Rhode Island
January 1913

New York's National Motor Truck Show

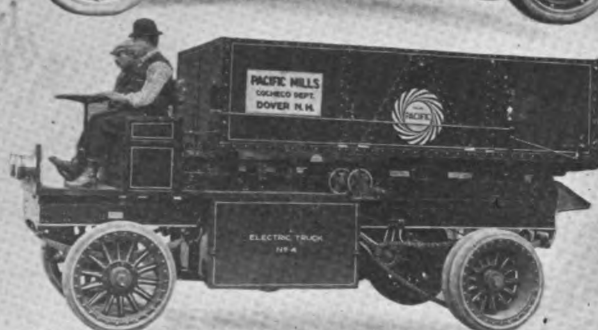
General Vehicle

Velie

Locomobile

Peerless

Pope-Hartford



General Vehicle

MADISON SQUARE GARDEN
GRAND CENTRAL PALACE

January 20-25-1913

THE NEW YORK MOTOR TRUCK SHOWS.

THE realization of the economic possibilities of motor vehicles is revolutionizing highway transportation, and because of this fact the exhibition of service wagons and trucks to be made at Madison Square Garden and Grand Central Palace, New York City, Jan. 20-25 inclusive, is of vast importance. While the displays will be worth the attention of any person from an educational point of view, as factors in business education they cannot be over-estimated. The cost of haulage and handling reaches enormous sums annually. The economy cannot be a result of system and co-operation and must be undertaken individually by the person or concern interested. Each problem differs from another because of conditions which cannot be controlled, and each must be worked out according to the resources and circumstances of those directly concerned.

Col. George Pope, Chairman, A. B. of T. Show Committee.

The service wagon shows will be of special and enduring value to each visitor. They will attract thousands who will hope to benefit through the information that may be gathered and the knowledge that may be applied in daily industrial and commercial life. They will have opportunity to study the differing forms of vehicles and the constructions created for general and special purposes, and to learn of the adaptations of the machines to meet the requirements of those who may be purchasers.

The service wagon canot be regarded as experimental other than in the sense of not being used generally. Its value has been proven beyond all question. It must be utilized, not with a purpose of merely supplanting animal transports, but as a means of economizing from every possibility. It has the same relation to road transportation that the telephone has to the telegraph, that express service has to the freight, that the trolley car has to the animal track vehicle. It is not to be assumed that the industrial conveyance has been perfected, but it will be admitted that there has been a marvelous development, which is due to the understanding by business men of the economic possibilities, although these have not been realized.

Demand has created the quality of practically every utility the world enjoys. The vehicles in use in America are numbered by millions. Estimates of the motor wagons now in service widely differ because there are no actually dependable figures, but it would seem that 50,000 is a conservative total. There are hundreds of types, and these have been produced with, as a rule, the idea of specializing the needs of those who would seem so numerous as to afford a separate and distinct market. There are today in the United States more than 200 different vehicle builders who are recognized in the industry as producing machines commercially, and there are nearly 100 other firms and individuals building and experimenting with the purpose of becoming as active factors as resources and the merit of their products will permit. In many instances the makers produce both pleasure and service vehicles, and there is a large proportion of manufacturers who devote themselves to the latter type.

Grand Central Palace, New York City, Where a Division of the 1913 Motor Truck Show Will Take Place.

The New York shows, which will be held Jan. 20-25, inclusive, in Madison Square Garden and Grand Central Palace, will be made up of the displays of 67 different manufacturers. Those who will visit the one exhibition building will hardly feel that they have satisfied their desire for information, unless the purpose is to examine a single or few machines, and it may be said that practically all visitors will see the productions of leaders of the industry. The exhibits will range from a single machine to perhaps a dozen, and

Madison Square Garden, New York City, Where a Division of the 1913 Motor Truck Show Will Take Place.

these will be the latest and most improved designs produced. It is not too broad a statement to make to place the probable total number at 350, and it is quite as probable that these will represent not far from 200 different sizes or types. There will be 25 makers having exhibits at the Madison Square Garden, and all of these will be gasoline vehicles. At Grand Central Palace 33 makers of gasoline machines will make display, and nine builders of electric wagons and trucks.

At the former exhibition building will be the stands of the older manufacturers, most of whom will have the same spaces they occupied with showings of pleasure cars, while at Grand Central Palace will be the exhibits of those who either build service vehicles exclusively, or are specially developing this division of their business. Here will be seen some of the latest machines and some that have never before been exhibited in the East. There will be more new productions at this building than at Madison Square Garden, and in addition there will be the best and most recent designs turned out by the leading builders of electric wagons and trucks.

Alfred Reeves, A. B. of T. Show Committee.

The Madison Square Garden show will be especially interesting from the fact that it will reflect the progression and development of the makers whose experience has been exceedingly broad, whose vehicles may be said to represent the industry, and have been perfected from the knowledge of actual service. There will be few radical machines shown by them. There will be new Buick wagons, shown for first time; the new water-cooled flexible chassis Kelly machines, the new Reo and the new Hupmobile wagons, while of course there will be additional types of some of the builders familiar to the industry.

At Grand Central Palace will be seen the new Blair, Brown, Gramm-Bernstein, Stewart and Standard machines, and new types developed in Chase, Rowe, Sanford and Schacht vehicles, while the Buffalo electric wagon will be seen for the first time. The electrics will be departmentalized, an innovation in metropolitan shows. There will be a number of vehicles of special interest in that the worm drive has been adopted, this being true of the new Rowe and Schacht wagons, and the Manly drive will be seen on the La France trucks to be shown by the Hydraulic Truck Sales Co. There will be innumerable adaptations and installations to convenience operation and economize in time, and a number of machines will be shown with starting devices.

The one feature that will appeal to all will be the special bodies built to meet the requirements of different forms of haulage and to facilitate handling the freight carried. These will represent the ideas of some of the most expert designers of the country, and will be worthy the careful study of every man who has to do with haulage. There will be numerous standard bodies, some of which have been created with the purpose of utilizing differing types of chassis.

Merle L. Downs, Secretary, A. B. of T. Show Committee.

Besides the vehicles themselves there will be all manner of constructional detail that will be closely exam- examined by those who are desirous of information.

Standard Specifications of Gasoline Service Wa

Durable Dayton 5-Ton Model M


Mack 6-Ton

Knox 5-Ton Model R-15

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P. S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
GASOLINE SERVICE WAGONS OF CAP											
Brooks, Brooks Mfg. Co.	1		800	2	3.750	3.750	1400	12	—	×	..
Cameron, Cameron Mfg. Co.	—		850	4	3.875	3.750	1000	24	—	×	—
Chase, Chase Motor Truck Co.	M		500	2	4.125	4.000	800	12	—	×	..
Dart, Dart Mfg. Co.	—		750	2	4.250	5.000	1000	15	×	—	—
Motorette, Kelsey Motor Co.	LI		250	2	3.750	3.750	1000	11.25	×	—	—
Motorette, Kelsey Motor Co.	NI		500	2	3.750	3.750	1200	11.25	×	—	—
Overland, Willys-Overland Co.	69	Express	800	4	4	4.5	1800	30	×	—	—
Overland, Willys-Overland Co.	69	Special	800	4	4	4.5	1800	30	×	—	—
Wagenhals, Wagenhals Motor Car Co.	—		800	4	3.5	3.375	700	20	×	—	×
GASOLINE SERVICE WAGONS OF CAPACIT											
Akron, Akron Motor Car & Truck Co.	A		1500	4	3.75	5	1000	22.5	×	—	—
Auglaize, Auglaize Motor Car Co.	H		1500	2	5.5	4	1200	18	×	—	×
Available, Available Truck Co.	15		1500	2	5.25	4	1200	22	×	—	×
Babcock, Babcock Co., H. H.	G		1500	2	5.25	4	1200	22	×	—	—
Bergdoll, Louis J. Bergdoll Motor Co.	C	Del.	1500	4	4	4.5	....	30	×	—	—
Bessemer, Bessemer Motor Truck Co.	A		1000	4	3.5	4.5	1000	18	×	—	—
Best, Durant-Dort Carriage Co.	A		1000	2	4.5	4.5	1200	12	×	—	..
Brockway, Brockway Motor Truck Co.	A		1500	3	4	5	1100	28.8	—	×	..
Chase, Chase Motor Truck Co.	D		1000	3	4.125	4	800	20	—	×	..
Crawford, Crawford Auto Co.	13-30		1200	4	4.25	4.5	1500	30	×	—	—
Croce, Croce Automobile Co., Inc.	A		1500	4	3.75	5	1600	22	×	—	—
Crown, Crown Commercal Car Co.	A		1500	4	3.75	4.5	1000	26	×	—	×
Dart, Dart Mfg. Co.	—		1500	4	3.25	5	1200	17	×	—	—
Day, Day Automobile Co.	D		1500	4	4	4.5	....	25.6	×	—	—
Detroit Motor Wagon, Motor Wagon Co. of Detroit	3		1000	4	3.25	3.375	1200	16	×	—	×
Dispatch, Dispatch Motor Car Co.	N		1000	4	3.5	5	900	35	—	×	..
Dispatch, Dispatch Motor Car Co.	L		1000	4	3.5	5	900	35	—	×	..
Dorris, Dorris Motor Car Co.	H-13		1500	4	4.375	5	1000	30.6	×	—	—
Dorris, Dorris Motor Car Co.	H-13		1500	4	4.375	5	1000	30.6	×	—	—
Flint, Durant-Dort Carriage Co.	C		1600	4	3.75	4.5	1333	22.5	×	—	—
Hatfield, Hatfield Auto Truck Co.	J		1000	3	4.125	4	1300	20	—	×	..
Ideal, Ideal Auto Co.	I		1500	4	3.5	4.5	1200	18	×	—	×
IHC, International Harvester Co.	M-A		1000	2	5	5	1000	20	—	×	—
IHC, International Harvester Co.	M-W		1000	2	4.5	5	1000	20	×	—	—
Kearns, Kearns Motor Car Co.	A		1500	3	4	4	1000	20	—	×	..
Kearns, Kearns Motor Car Co.	A		1500	4	4	4	1000	20	×	—	×
KisselKar Truck, Kissel Motor Car Co.	—		1500	4	4.25	4.25	....	30	×	—	—
Koehler Commercial, H. J. Koehler S. G. Co.	—		1600	2	5.25	4	1000	22	×	—	—
Krebs, Krebs Commercial Car Co.	B		1500	2	4.5	5	900	16	×	—	..
K-R-I-T, K-R-I-T Motor Car Co.	KD		1000	4	3.75	4	....	22.5	×	—	×
Lambert, Buckeye Mfg. Co.	—		1500	4	3.5	4.25	1200	19.6	×	—	—
Landshaft, Wm. Landshaft & Sons	B		1000	4	3.25	4	1200	18	×	—	×
Landshaft, Wm. Landshaft & Sons	C		1500	4	3.25	5	900	20	×	—	×
Lippard-Stewart, Lippard-Stewart Motor Car Co.	—		1500	4	3.75	5.25	1200	30	×	—	—
Lippard-Stewart, Lippard-Stewart Motor Car Co.	—		1500	4	3.75	5.25	1200	30	×	—	—
Luck Utility, Cleburne Motor Car Mfg. Co.	—		1000	4	3.25	4	1000	17	×	—	—
Marmon, Nordyke & Marmon Co.	—		1500	4	4	5	1050	26	×	—	—
Mason, Mason Motor Co.	12		1200	2	5	5	600	20	×	—	—

Axles—1, tubular; 2, I section; 3, rectangular; 4, solid forging; 5, dead; 6, semi-floating; 7, three-quarter floating; 8, full steel; 3, armored wood. Clutch—1, cone; 2, contracting band; 3, expanding band; 4, multiple disc; 5, disc; 6, friction; 7, plane-
‡, double grooved roller friction drive; **, gravity; ¶, steel.


King 3.5-Ton


Randolph 2-Ton Model N

gons of American Make Produced for 1913.

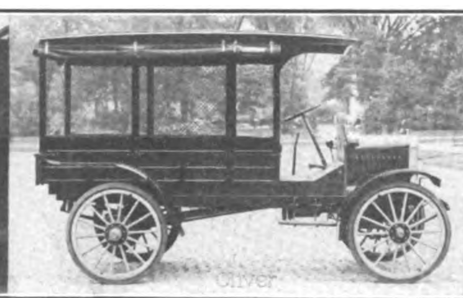
Wolverine Detroit Model C

Wagenhals

Little Giant

Lubrication, Force Feed	Lubrication, Combination	Ignition Magneto	Ignition, Battery	Clutch	Speed Ratio Forward	Speed Ratio, Reverse	Wheelbase, Inches	Drive, Shaft	Drive, Chain	Drive, Double Chain	Friction Drive.	Frame Material	Springs Front	Rear	Axles, Front	Axles, Rear	Brakes	Tires, Front	Tires, Rear	Drive, Right	Drive, Left	Price
ACITIES OF LESS THAN 1000 POUNDS.																						
*	..	×	—	7	2	1	87	—	—	—	‡	2	......	......	4	4	1	40x1.62	42x1.75	×	×	$600.00
×	—	×	—	1	3	1	104	×	—	—	—	2	34x1.5	38x1.5	1	8	1	30x3.5	30x3.5	×	—	725.00
*	..	×	—	7	2	1	86	—	—	×	—	1	34x1.5	40x1.75	3	3	1	34x2	36x2	—	×	500.00
—	×	×	—	7	2	1	90	—	×	—	—	2	37x1.75	38x2	2	2	2	34x2.5	36x2.5	×	—	750.00
×	—	×	—	1	2	1	72	—	×	—	—	2	......	30x1.5	2	5	1	28x3	29x3.5	..	..	400.00
×	—	×	—	1	2	1	72	—	×	—	—	2	......	30x1.5	2	5	1	28x3	29x3.5	..	..	500.00
—	×	×	—	1	3	1	110	×	—	—	—	2	26x1.75	40x1.75	2	7	1	33x4	33x4	×	—	900.00
—	×	×	—	1	3	1	110	×	—	—	—	2	36x1.75	40x1.75	2	7	1	33x4	33x4	×	—	1,000.00
—	—	×	—	..	2	1	80	—	×	—	—	2	36x1.75	42x1.75	..	..	1	28x3	32x4	..	..	600.00
IES RANGING FROM 1000 TO 2000 POUNDS.																						
—	×	×	—	5	3	1	118	×	—	—	—	2	38x2	50x2.25	2	6	1	34x4	34x4	×	—	1,350.00
—	—	×	—	..	1	1	100	—	×	—	—	2	40x2	50x2	2	3	1	36x2.5	36x2.5	×	—	1,050.00
—	—	×	—	4	2	1	100	—	—	×	—	2	36x1.75	36x1.75	2	3	1	34x2	34x2	×	—	900.00
×	—	×	—	4	3	1	100	—	×	—	—	2	37.5x2	44x2	2	1	1	34x3	34x3	×	—	1,400.00
—	×	×	—	4	3	1	115	×	—	—	—	2	39x2	45x2	2	8	1	34x4	34x4	..	..	1,600.00
×	—	×	—	1	3	1	102	—	—	×	—	2	......	......	3	3	1	34	34	..	..	1,200.00
..	..	×	×	6	..	..	76	—	—	×	—	2	38x1.75	36x1.75	3	3	1	32x2	34x2.5	..	..	750.00
*	..	×	—	7	2	1	100	—	—	×	—	3	34x1.75	36x2	3	3	1	36x2	38x2.5	—	×	875.00
*	..	×	—	..	2	1	100	—	—	×	—	1	35x1.75	35x1.75	3	3	1	36x2	38x2.5	×	—	900.00
×	—	×	—	8	3	1	112	×	—	—	—	2	36x2	36x2	1	8	1	32x3.5	33x4	×	—	1,450.00
×	—	×	—	1	3	1	110	×	—	—	—	2	44x2.25	48x2.25	4	8	1	34x4.5	34x4.5	..	..	1,650.00
—	—	×	—	4	3	1	104	—	×	—	—	2	40x2	38x2	3	3	2	36x2.5	36x2.5	..	..	1,250.00
—	×	..	..	1	3	1	114	—	—	×	—	2	38x2	50x2.25	2	2	2	34	36	—	×	1,100.00
—	×	×	×	4	3	1	115	×	—	—	—	2	40x2	52x2	2	8	1	34x4	34x4	×	—	1,500.00
—	—	×	—	7	2	1	100	—	—	×	—	2	36.25x2	30x1.75	1	4	..	32x2	32x2.5	—	×	900.00
*	..	×	—	6	..	..	120	—	—	—	×	3	40x1.75	40x1.75	1	1	1	36x2	36x2	×	—	800.00
*	..	×	—	6	..	..	120	—	—	—	×	3	40x1.75	40x1.75	1	1	1	36x2	36x2	×	—	800.00
—	×	×	—	4	3	1	132	×	—	—	—	2	37x2	42x2	2	8	1	35x4.5	35x4.5	×	—	2,100.00
—	×	×	—	4	3	1	138	×	—	—	—	2	37x2	42x2	2	8	1	35x4.5	35x4.5	×	—	2,100.00
×	—	×	×	1	3	1	100	×	—	—	—	2	40x2.25	48x2.25	2	8	1	34x2.5	34x4	..	..	......
*	..	×	—	6	..	..	88	—	—	—	×	2	36x2	40	4	4	2	34	34	..	..	850.00
—	—	×	—	3	3	1	109	—	—	×	—	3	36x2	38x2	3	3	2	36x3	36x3.5	×	—	1,500.00
—	×	×	—	2	2	1	90	—	—	×	—	3	36x1.5	36x1.75	3	5	2	......	......	×	—	......
—	×	×	—	2	2	1	90	—	—	×	—	3	36x1.5	36x1.75	3	5	2	......	......	×	—	......
*	..	×	—	6	..	..	100	—	—	×	—	3	34x2	36x2	3	3	1	34x2	34x2	×	—	1,075.00
—	—	×	—	6	..	..	100	—	—	×	—	3	34x2	36x2	3	3	1	36x2	36x2	×	—	1,225.00
—	×	×	—	1	3	1	120	×	—	—	—	2	35x2	54x2.25	2	8	1	35x4.5	35x4.5	×	—	1,500.00
×	—	×	—	1	2	1	86	—	—	×	—	2	36x1.75	36x1.75	3	3	2	36x2.5	48x2.5	—	×	750.00
*	..	×	—	1	3	1	100	×	—	—	—	2	40x2	50x2	2	8	1	34x4	34x4	—	×	1,375.00
—	—	×	—	4	3	1	106	×	—	—	—	2	27x1.5	38x1.75	2	6	1	32x3.5	32x3.5	—	×	900.00
—	×	×	—	6	..	..	114	—	—	—	×	2	39x1.75	44x2.5	1	1	2	......	......	×	—	1,200.00
—	—	×	—	7	2	1	90	—	—	×	—	2	40x2	44x1.75	3	3	1	34x2	36x2	×	—	......
—	—	×	—	7	2	1	96	—	—	×	—	2	40x2	44x2	3	3	1	34x2.5	36x2.5	×	—	......
×	—	×	—	1	3	1	115	×	—	—	—	2	40x2	51x2.25	2	8	1	35x4.5	35x4.5	—	×	1,775.00
×	—	×	—	1	3	1	125	×	—	—	—	2	40x2	51x2.25	2	8	1	35x4.5	35x4.5	—	×	1,775.00
×	—	×	—	7	2	1	115	×	—	—	—	2	37.5x2	44x2	2	8	1	36x3.5	36x3.5	×	—	......
×	—	×	—	1	3	1	120	×	—	—	—	2	35x2	40x2	2	8	1	32x4	32x4	..	..	2,500.00
—	×	×	..	1	2	1	96	—	×	—	—	2	40x2	38x1.75	1	6	1	32x3.5	32x3.5	×	—	800.00

floating. Brakes—1, rear wheels; 2, jackshaft and rear **wheels**; 3, propellor shaft and rear wheels. Frame—1, wood; 2,
tary transmission; 8, multiple cone. Symbols—×, yes, —, **no**; =, worm drive; †, concentric gearing; *, oil fed with gasoline;



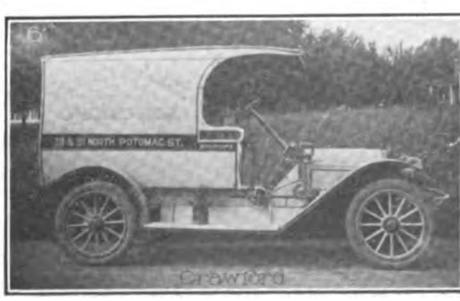
Oliver

Alco 6.5-Truck

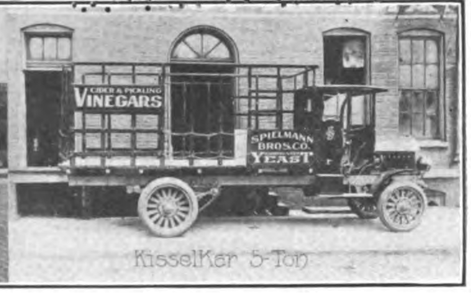
Four Wheel Drive

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Mercury, Mercury Mfg. Co.	P-1		1000	2	4.25	4	1000	14.8	—	×	—
Modern, Bowling Green Motor Car Co.	B		1000	4	3.75	4.5	1500	25	×	—	×
Modern, Bowling Green Motor Car Co.	A		1500	4	4.125	5.25	1500	35	×	—	×
Modern, Bowling Green Motor Car Co.	A		1500	4	4.125	5.25	1500	35	×	—	×
Moore, Palmer-Moore Co.	C		1600	3	4	4	950	20	—	×	..
Mora, Mora Power Wagon Co.	20		1500	2	4.5	4.5	....	16.2	×	—	—
Oliver, Oliver Motor Truck Co.	10A		1500	2	5	5	900	20	×	—	—
Reo, Reo Motor Truck Co.	H		1500	1	4.75	6	500	12	×	—	×
Sandusky, Sandusky Auto Parts & Motor Truck Co.	B		1500	4	3.75	5	1200	22.5	×	—	—
Schacht, Schacht Motor Car Co.	12		1500	4	4.25	5.5	1200	30	×	—	—
Schacht, Schacht Motor Car Co.	14		1800	4	4.25	5.5	1200	30	×	—	—
Service, Service Motor Car Co.	J		1500	4	3.75	5.5	....	22.5	×	—	—
Siebert, The Shop of Siebert	H		1500	4	3.75	4.5	1000	22	×	—	×
Stanley Steamer, Stanley Motor Carriage Co.	—		1500	2	4	5	....	20	..	..	—
Stegeman, Stegeman Motor Car Co.	—		1500	4	3.75	5.25	1200	30	×	—	—
Stewart, Stewart Motor Corp.	A		1500	4	3.75	5.25	1200	22.5	×	—	—
Sullivan, Sullivan Motor Car Co.	20		1000	2	4.5	4.5	1000	16.2	×	—	—
Sullivan, Sullivan Motor Car Co.	51		1500	2	4.5	4.5	1000	16.2	×	—	—
Tulsa, Tulsa Automobile & Mfg. Co.	10		1500	4	4.75	4.5	....	25	×	—	—
White, White Co.	GBE		1500	4	3.75	5.125	....	30	×	—	—
Wolverine-Detroit, Pratt, Carter, Sigsbee & Co.	C		1000	1	4.5	5.5	1000	8.1	×	—	×
GASOLINE SERVICE WAGONS OF CAPACIT											
Adams, Adams Bros. Co.	A		2000	4	3.875	5	1200	30	×	—	—
Adams, Adams Bros. Co.	A		2000	4	3.875	5	1200	30	×	—	—
Auglaize, Auglaize Motor Car Co.	D		2000	4	3.75	5.25	1200	25	×	—	—
Available, Available Truck Co.	24		2000	4	3.75	4.5	1000	22.5	×	—	×
Avery, Avery Co.		C	2000	..	....	....	....	....	..	..	..
Bessemer, Bessemer Motor Truck Co.	B		2000	4	3.75	5.25	1000	22	×	—	—
Brockway, Brockway Motor Truck Co.	B		2000	3	4	5	1100	28.8	—	×	..
Brockway, Brockway Motor Truck Co.	C		2000	3	4	5	1100	28.8	—	×	..
Cameron, Cameron Mfg. Co.	—		2000	4	3.875	3.75	1000	24	—	×	×
Cass, Cass Motor Truck Co.	1912		2000	4	4	4.5	1200	25.6	×	—	×
Cass, Cass Motor Truck Co.	1912		2000	4	4	4.5	1200	25.6	×	—	×
Cass, Cass Motor Truck Co.	1912		2000	4	4	4.5	1200	25.6	×	—	×
Chase, Chase Motor Truck Co.	H		2000	3	4.125	4	800	20	—	×	..
Chase, Chase Motor Truck Co.	K		2000	3	4.125	4	800	20	—	×	—
Coleman, Coleman Motor Truck Co.	B		2000	4	3.75	5.25	....	22	×	—	—
Croce, Croce Automobile Co., Inc.	C		2400	..	4.75	5.5	1400	40	×	—	—
Crow Elkhart, Crow Motor Car Co.	CD		2350	4	4	4.5	2400	33	×	—	×
Crown, Crown Commercial Car Co.	B		2000	4	3.75	4.5	1000	26	×	—	×
Dart, Dart Mfg. Co.	C		2500	4	4.125	5.5	1000	27	×	—	—
Federal, Federal Motor Truck Co.	C		2000	4	4.25	4.5	1015	28.9	×	—	—
Federal, Federal Motor Truck Co.	D		2000	4	4.25	4.5	1015	28.9	×	—	—
G. M. C., General Motors Truck Co.	VC		2500	4	3.5	5.25	1160	19.6	×	—	—
Gramm, Gramm Motor Truck Co.	1		2000	4	4.25	4.5	1150	28.9	×	—	×
Hatfield, Hatfield Auto Truck Co.	K		2000	3	4.125	4	1300	20	—	×	..
Ideal, Ideal Auto Co.	H		2000	4	3.75	5.25	1000	22	×	—	—
Jatco, Joliet Auto Truck Co.	D	2	2000	2	5.25	4	1250	22	×	—	—
Kato, The Four Traction Auto Co.	F		2000	4	3.75	4.25	1000	22	×	—	×
Kelly, Kelly-Springfield Motor Truck Co.	K30		2000	4	3.75	5.25	1200	30	×	—	—
Kelly, Kelly-Springfield Motor Truck Co.	K30		2000	4	3.75	5.25	1200	30	×	—	—
KisselKar Truck, Kissel Motor Car Co.	—		2000	4	4.5	5.25	....	30	×	—	—
Krebs, Krebs Commercial Car Co.	A		2000	2	4.5	5	900	16.2	×	—	..
Lambert, Buckeye Mfg. Co.	—		2000	4	4.125	4.5	....	27.3	×	—	—
Landshaft, Wm. Landshaft & Sons	G		2000	4	3.75	4.5	900	28	×	—	×
Lauth-Juergens, Lauth-Juergens Motor Car Co.	K		2000	4	3.75	5.25	1200	30	×	—	—

Axles—1, tubular; 2, I section; 3, rectangular; 4, solid forging; 5, dead; 6, semi-floating; 7, three-quarter floating; 8, full steel; 3, armored wood. Clutch—1, cone; 2, contracting band; 3, expanding band; 4, multiple disc; 5, disc; 6, friction; 7, plane-
‡, double grooved roller friction drive; **, gravity; ¶, steel.


Crawford


Federal 1-Ton



KisselKar 5-Ton

Lubrication, Force Feed	Lubrication, Combination	Ignition Magneto	Ignition, Battery	Clutch	Speed Ratio Forward	Speed Ratio, Reverse	Wheelbase, Inches	Drive, Shaft	Drive, Chain	Drive, Double Chain	Friction Drive.	Frame Material	Springs Front	Rear	Axles, Front	Axles, Rear	Brakes	Tires, Front	Tires, Rear	Drive, Right	Drive, Left	Price
×	—	×	—	4	2	1	85	—	—	×	—	3	36x1.5	36x1.5	3	3	1	38x2	40x2	×	—	750.00
—	—	×	—	1	3	1	110	—	—	×	—	2	38x2	41.5x2	2	2	2	33x3.5	33x3.5	—	×	1,200.00
—	—	×	—	1	3	1	120	—	—	×	—	2	39x2	48x2	2	2	2	36x3	36x3.5	—	×	1,600.00
—	—	×	—	1	3	1	136	—	—	×	—	2	39x2	48x2	2	2	2	36x3	36x3.5	—	×	1,600.00
*	..	×	—	..	2	1	102	—	—	×	—	2	38x2	42x2	2	2	2	36x2.5	36x3	×	—	1,600.00
—	×	×	—	4	2	1	94	--	—	×	—	2	39x2	43x2	4	5	1	36x2	36x2.5	—	×	1,000.00
×	—	×	..	4	2	1	102	×	—	—	—	2	44x2.5	44x2.5	2	8	3	38x3	38x3.5	—	×	1,250.00
—	—	—	×	4	2	1	90	—	—	×	—	2	......	......	2	1	2	36x2.5	36x2.5	..	..	760.00
×	—	×	—	1	3	1	120	—	—	×	—	2	38x2	40x2	3	5	2	34x4	34x4.5	—	×	1,400.00
×	—	×	×	1	3	1	120	×	—	—	—	2	38x2	46.25x2	2	8	1	34x4	34x4	—	×	1,600.00
×	—	×	—	1	3	1	138	×	—	—	—	2	38x2	46.25x2	2	8	1	35x4.5	35x4.5	—	×	2,000.00
×	—	×	—	6	..	..	115	—	—	×	—	..	......	......	4	2	1	36x3	36x3	—	×	1,400.00
—	—	×	—	1	3	1	112	—	—	×	—	2	36x2	36x2	3	3	2	36x2.5	36x3	..	..	......
×	--	..	..	..	..	..	130	..	..	..	..	1	38x1.75	38x1.75	1	1	1	34x4.5	34x4.5	×	—	1,325.00
—	×	×	—	4	3	1	125	×	—	—	—	2	40x2	50x2	2	8	3	34x2.5	34x3.5	—	×	1,600.00
×	—	×	—	4	3	1	125	×	—	—	—	2	38x2	50x2.25	2	8	1	34x4	35x4.5	—	×	1,800.00
×	—	×	—	4	2	1	95	—	—	×	—	2	36x1.75	38x1.75	3	3	2	36x2.5	36x2.5	—	×	1,050.00
×	—	×	—	4	2	1	120	—	—	×	—	2	36x1.75	38x1.75	3	3	2	36x2.5	36x3	—	×	1,100.00
—	×	×	×	1	3	1	116	—	—	×	—	2	40x1.75	40x1.75	2	3	2	36x3	35x3.5	×	—	1,500.00
—	×	×	—	1	4	1	120	×	—	—	—	2	......	......	2	8	1	34x4.5	34x4.5	×	—	2,100.00
—	—	×	×	6	..	..	96	=	—	—	—	2	40x2	40x2	2	6	1	33x4	33x4	—	×	800.00

IES RANGING FROM 2000 TO 3000 POUNDS.

—	×	×	—	4	3	1	121	—	—	×	—	2	44x2.25	44x2.5	2	3	2	36x3.5	36x4	..	..	2100.00
—	×	×	—	4	3	1	136	—	—	×	—	2	44x2.25	44x2.5	2	3	2	36x3.5	36x4	..	..	2100.00
—	×	×	—	4	2	1	110	—	—	×	—	2	40x2.5	40x2.5	2	3	1	36x3.5	40x4	×	—	1,850.00
—	—	×	—	1	3	1	102	—	—	×	—	2	36x1.75	36x1.75	2	3	2	34x2.5	34x3	—	×	1,350.00
..	..	..	..	..	..	..	...	..	..	..	..	..	......	..	..	......	......	.. ..	..	......		......
×	—	×	—	1	3	1	120	—	×	—	—	2	......	......	2	3	1	34	34	..	..	1,800.00
*	..	×	—	5	2	1	106	—	—	×	—	3	34x2	44x2.5	2	3	1	36x2.5	38x3	—	×	1,150.00
*	..	×	—	1	3	1	106	—	—	×	—	3	34x2	44x2.5	2	3	2	36x2.5	38x3	—	×	1,300.00
—	—	×	—	1	3	1	108	—	—	×	—	2	38x2	38x2	2	5	2	36x2.5	36x2.5	×	—	1,300.00
—	—	×	—	1	2	1	119	—	—	×	—	2	47x2.5	40x2.25	2	5	1	34x3.5	34x4	×	—	1,850.00
—	—	×	—	1	2	1	122	—	—	×	—	2	47x2.5	40x2.25	2	5	1	34x3.5	34x4	×	—	1,850.00
—	—	×	—	1	2	1	129	—	—	×	—	2	47x2.5	40x2.25	2	5	1	34x3.5	34x4	×	—	1,850.00
*	..	×	—	1	2	1	106	—	—	×	—	1	37x2	37x2	3	3	1	36x2.5	38x3	×	—	1,250.00
*	..	×	—	1	3	1	106	—	—	×	—	1	37x2	37x2	3	3	1	36x2.5	38x3	×	—	1,400.00
—	×	×	—	1	3	1	107	—	—	×	—	2	40x2	40x2	2	2	2	36x3.5	36x4	×	—	1,950.00
×	—	×	—	1	3	1	160	—	—	×	—	2	44x3	48x3	4	4	2	36x4	36x5	..	..	......
—	—	×	—	4	3	1	114	×	—	—	—	2	36x2	38x2	2	7	1	34x3.5	34x3.5	×	—	......
—	—	×	—	4	3	1	120	—	—	×	—	2	40x2	38x2.5	4	4	2	36x3	36x3	×	—	1,500.00
—	×	×	×	1	3	1	130	—	—	×	—	2	40x2.5	58x2.5	2	5	1	34x3.5	38x3.5	—	×	1,800.00
×	—	×	—	1	3	1	110	—	—	×	—	2	40x2	44x2.5	2	3	2	36x3.5	36x4	—	×	1,800.00
×	—	×	—	1	3	1	144	—	—	×	—	2	40x2	44x2.5	2	3	2	36x3.5	36x4	—	×	1,800.00
—	×	×	—	1	3	1	126	—	×	—	—	2	38	44	2	3	1	34x3	36x5	—	×	2,075.00
—	—	×	—	4	3	1	106	—	—	×	—	2	38.75x2.5	38.75x2.5	3	5	2	34x3.5	34x3.5	×	—	1,750.00
*	..	×	—	6	..	..	96	—	—	—	×	2	36x2	44x2	4	4	2	34x3	34x3.5	..	..	1,200.00
—	×	×	—	1	3	1	120	—	—	×	—	2	40x2.5	40x2.5	2	3	2	36x3.5	36x4	×	—	1,750.00
×	—	×	—	4	2	1	91	—	—	×	—	2	36x1.75	40x2	2	2	2	34x3	34x3	..	..	1,250.00
—	—	×	×	1	3	1	110	×	—	—	—	2	40x2	44x2	1	8	5	32x2	32x2	×	—	......
×	—	×	—	1	3	1	120	—	—	×	—	2	40	42	2	2	1	36x3.5	36x4	—	×	2,000.00
×	—	×	—	1	3	1	144	—	—	×	—	2	40	42	2	2	1	36x3.5	36x4	—	×	2,000.00
×	—	×	—	1	4	1	132	×	—	—	—	2	38x2	54x2.25	2	8	1	37x5	37x5	×	—	2,000.00
*	..	×	—	1	3	1	100	—	×	—	—	2	40x2	50x2	2	3	1	34x3	34x3	—	×	1,375.00
—	×	×	—	6	..	..	114	—	—	—	×	2	44x2.5	48x2.5	2	2	2	36x3	36x3.5	×	—	1,800.00
—	—	×	—	1	3	1	124	—	—	×	—	2	42x2.5	44x2.5	2	3	2	34x3	36x3.5	×	—	......
—	×	×	—	4	3	1	110	—	—	×	—	2	40x2.5	48x2.5	2	3	2	36x3.5	36x4	×	—	2,100.00

floating. Brakes—1, rear wheels; 2, jackshaft and rear wheels; 3, propellor shaft and rear wheels. Frame—1, wood; 2,
tary transmission; 8, multiple cone. Symbols—×, yes; —, no; =, worm drive; †, concentric gearing; *, oil fed with gasoline;

Packers Model B


Lippard-Stewart


Available Model 24

9 Croce Model A — Blair 2.5-Ton — Universal

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P.: S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Little Giant, Chicago Pneumatic Tool Co.	D		2000	2	5	4	1100	20	×	—	—
Little Giant, Chicago Pneumatic Tool Co.	D		2000	2	5	4	1100	20	×	—	—
Lord Baltimore, Lord Baltimore Motor Car Co.	C		2000	4	3.75	5	1000	22.5	×	—	—
Martin, Martin Carriage Works	S		2000	4	4	5	900	25.6	×	—	—
Monitor, Monitor Automobile Works	C		2000	2	5.25	4.75	1150	24	×	—	—
Monitor, Monitor Automobile Works	D		2000	4	3.75	5	1200	28	×	—	—
Moreland, Moreland Motor Truck Co.	B		2500	4	3.75	5.25	....	22.5	×	—	—
Natco, National Motor Truck Co.		15	2000	4	3.5	5	900	20	×	—	—
Penn-Unit, Penn-Unit Mfg. Co.	—		2000	2	5	5.5	800	20	×	—	—
Practical Piggins, Piggins Motor Truck Co.	—		2000	4	4.25	4.75	1000	30	×	—	—
Randolph, Randolph Motor Truck Co.	D		2000	4	3.75	5.25	950	22.5	×	—	—
Rowe, Rowe Motor Mfg. Co.	B		2000	4	4.25	5	....	35	×	—	—
Rowe, Rowe Motor Mfg. Co.	B		2000	4	4.25	5	....	35	×	—	—
Sanford, Sanford Motor Truck Co.	K		2000	4	4	4.25	1000	25.6	×	—	—
Service, Service Motor Car Co.	K		2000	4	3.75	5.5	....	22.5	×	—	—
Service, Service Motor Car Co.	L		2000	4	3.75	5.5	....	22.5	×	—	—
Siebert, The Shop of Siebert	F		2500	4	3.75	5.25	1000	30	×	—	×
Stegeman, Stegeman Motor Car Co.	—		2000	4	3.75	5.25	1200	30	×	—	—
Superior, F. G. Clark Co.	A		2000	4	3.75	5.25	1000	30	×	—	—
Toledo Truck, Toledo Motor Truck Co.	A		2000	4	4.125	5.25	1200	30	×	—	×
Toledo Truck, Toledo Motor Truck Co.	A		2000	4	4.125	5.25	1200	30	×	—	×
Tulsa, Tulsa Automobile & Mfg. Co.	—		2000	4	4.125	5.25	....	45	×	—	—
Universal, Universal Motor Truck Co.	—		2000	4	3.75	5.25	1100	30	×	—	—
Veerac, Veerac Motor Co.	B		2000	2	4	4	900	20	—	×	..
Wichita, Wichita Falls Motor Co.	A		2000	4	3.25	5	1000	17	×	—	—
Wilcox Trux, H. E. Wilcox Motor Car Co.	—		2000	4	4.25	4.5	....	26.9	×	—	×

10 Smith-Milwaukee 3.5-Ton — Autocar — Toledo

GASOLINE SERVICE WAGONS OF CAPACIT

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P.: S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Adams, Adams Bros. Co.	D		3000	4	3.875	5	1200	30	×	—	—
Adams, Adams Bros. Co.	D		3000	4	3.875	5	1200	30	×	—	—
The Autocar, The Autocar Co.	21		3000	2	4.75	4.5	....	18	×	—	×
Bessemer, Bessemer Motor Truck Co.	C		3000	4	3.75	5.25	1000	22	×	—	—
Blair, Blair Mfg. Co.	C		3000	4	4.125	5.25	....	30	×	—	—
Blair, Blair Mfg. Co.	C		3000	4	4.125	5.25	....	30	×	—	—
Brockway, Brockway Motor Truck Co.	D		3500	3	4.5	5	1100	24	—	×	..
Continental, Continental Truck Mfg. Co.	A.	E.	3500	4	3.25	4.25	1200	35	×	—	—
Crown, Crown Commercial Car Co.	C		3000	4	4.125	5	1000	30	×	—	×
Decatur, Grand Rapids Motor Truck Co.	H	B	3000	4	3.75	5.25	1500	22.5	×	—	×
Four Wheel Drive, Four Wheel Drive Auto Co.	G		3500	4	4.5	5	1000	28.9	×	—	—
Landshaft, Wm. Landshaft & Sons	J		3000	4	4.125	5.25	900	35	×	—	×

Axles—1, tubular; 2, I section; 3, rectangular; 4, solid forging; 5, dead; 6, semi-floating; 7, three-quarter floating; 8, full steel; 3, armored wood. Clutch—1, cone; 2, contracting band; 3, expanding band; 4, multiple disc; 5, disc; 6, friction; 7, plane- ‡, double grooved roller friction drive; **, gravity; ¶, steel.

11 Longest — Pierce Arrow 5-Ton — Standard 5-Ton

12

GMC Model H

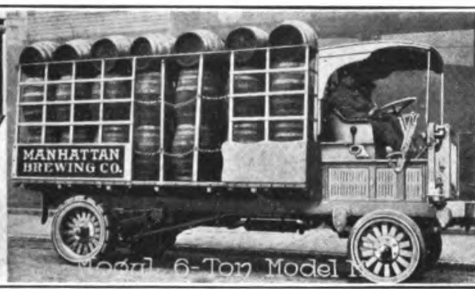
Hatfield Model K

Sternberg 4-Ton

Lubrication, Force Feed	Lubrication, Combination	Ignition Magneto	Ignition, Battery	Clutch	Speed Ratio Forward	Speed Ratio, Reverse	Wheelbase, Inches	Drive, Shaft	Drive, Chain	Drive, Double Chain	Friction Drive.	Frame Material	Springs Front	Rear	Axles, Front	Axles, Rear	Brakes	Tires, Front	Tires, Rear	Drive, Right	Drive, Left	Price
×	—	×	×	4	2	1	91	—	×	—	—	2	36x1.75	36x1.75	4	4	1	36x2	36x2.5	×	—	1,100.00
×	—	×	—	5	2	1	91	—	×	—	—	2	36x1.75	36x1.75	4	4	1	36x2	36x2.5	×	—	1,100.00
×	—	×	—	1	3	1	130	×	—	—	—	2	36x2.5	50x2.5	2	8	1	34x4	36x4	—	×	2,100.00
×	—	×	×	4	3	1	120	—	—	×	—	3	42x2.25	48x2.5	2	3	2	36x2.5	40x4	×	—	......
—	×	×	—	1	3	1	100	×	—	—	—	2	40x2	40x2	2	6	1	34x3.5	34x3.5	×	—	1,500.00
—	×	×	—	4	3	1	100	×	—	—	—	2	40x2	40x2	2	6	1	34x3.5	34x3.5	×	—	1,700.00
—	×	×	—	1	3	1	120	—	—	×	—	2	40x2	46x2	2	5	2	34x3.5	34x4	×	—	......
×	—	×	—	1	3	1	104	—	×	—	—	2	46x2.5	52x2.5	3	3	1	36x3.5	36x3.5	—	×	1,925.00
×	—	×	—	5	3	1	90	—	×	—	—	2	38x2	42x2	3	3	1	36x2.5	40x2.5	—	×	1,800.00
×	—	×	—	1	3	1	115	†	—	—	—	2	40x2.5	44x2.5	2	5	2	36x3.5	36x4	..	..	1,750.00
×	—	×	—	1	3	1	114	—	×	—	—	2	44x2.5	48x2.5	2	4	1	34x3.5	36x4	..	..	1,750.00
×	—	×	—	4	3	1	120	—	×	—	—	2	40x2	50x2.5	2	3	1	34x3.5	34x4	×	—	2,250.00
×	—	×	—	4	3	1	130	—	×	—	—	2	40x2	50x2.5	2	3	1	34x3.5	34x4	×	—	2,250.00
×	—	×	×	4	3	1	106	—	—	×	—	2	......	......	2	3	2	36x3.5	36x3.5	×	—	1,600.00
×	—	×	—	6	..	..	115	—	×	—	—	..	......	......	4	2	1	34x3	34x3.5	—	×	1,500.00
×	—	×	—	6	..	..	115	—	×	—	—	..	......	......	2	1	1	34x3	34x3.5	—	×	1,600.00
—	—	×	—	4	3	1	120	—	—	×	—	2	38x2.25	38x2.25	2	3	2	36x3.5	36x4	..	..	......

13

Penn-Unit ... Ton



Mogul 6-Ton Model ...

Garford 5-Ton Model D

—	×	×	—	4	3	1	130	—	—	×	—	2	42x2.25	54x2.25	2	3	3	34x3	36x4	—	×	2,250.00
×	—	×	—	1	3	1	110	—	—	×	—	2	40x2.25	48x2.25	2	4	2	36x3	36x3.5	×	—	1,700.00
—	—	×	—	4	3	1	102	—	—	×	—	2	38x2.25	42x2.25	2	5	2	36x3	36x3.5	×	—	1,700.00
—	—	×	—	4	3	1	115	—	—	×	—	2	38x2.25	42x2.25	2	5	2	36x3	36x3.5	×	—	1,700.00
—	×	×	—	1	3	1	132	—	—	×	—	2	38x2	48x2	2	5	1	36x3.5	36x4	×	—	2,000.00
—	×	×	—	5	3	1	130	=	—	—	—	2	38x2.5	48x2.5	4	8	1	36x3.5	36x5	—	×	1,950.00
•	..	×	—	4	2	1	86	—	—	×	—	3	40x1.75	38x1.75	3	3	1	36x2.5	36x3	—	×	1,100.00
—	×	×	—	1	3	1	110	—	—	×	—	2	40x2.25	44x2.5	2	3	2	34x3	34x4	×	—	1,650.00
—	—	×	—	1	3	1	116	—	—	×	—	2	......	......	2	4	2	36x3	36x3.5	..	..	2,300.00

IES RANGING FROM 3000 TO 4000 POUNDS.

—	×	×	—	4	3	1	121	—	—	×	—	2	44x2.5	44x2.5	2	3	2	36x3.5	36x3	..	..	2,300.00
—	×	×	—	4	3	1	136	—	—	×	—	2	44x2.5	44x2.5	2	3	2	36x3.5	36x3	..	..	2,300.00
—	—	×	—	5	3	1	97	×	—	—	—	3	40x2.25	45x2.5	1	8	1	34x3	34x4	×	—	2,150.00
×	—	×	—	1	3	1	136	—	—	×	—	2	......	......	2	3	..	......	......	..	..	2,100.00
—	×	×	—	1	3	1	114	=	—	—	—	2	40x2.5	52x2.5	2	8	2	34x4	34x3	×	—	3,000.00
—	×	×	—	1	3	1	121	=	—	—	—	2	40x2.5	52x2.5	2	8	2	34x4	34x3	×	—	3,000.00
•	..	×	—	1	3	1	112	—	—	×	—	3	34x2	44x2.5	2	3	1	36x3	38x4	—	×	1,800.00
—	×	×	—	1	3	1	120	—	—	×	—	2	40x2.5	50x2.5	2	3	1	36x3	40x4	×	—	1,850.00
—	—	×	—	4	3	1	130	—	—	×	—	2	40x2.25	50x2.5	2	3	2	36x3.5	36x4	×	—	2,000.00
—	—	×	—	4	3	1	130	—	—	×	—	2	40x2.25	45x2.25	2	4	2	34x5	34x3.5	×	—	2,500.00
×	—	×	—	4	3	1	124	×	—	—	—	2	42x2.25	44x2.25	8	8	3	36x4	36x4	×	—	3,600.00
—	—	×	—	1	3	1	134	—	—	×	—	2	42x2.5	44x2.5	2	3	2	34x3.5	36x4	×	—	......

floating. Brakes—1, rear wheels; 2, jackshaft and rear wheels, 3, propellor shaft and rear wheels. Frame—1, wood; 2, tary transmission; 8, multiple cone. Symbols—×, yes; —, no; =, worm drive; †, concentric gearing; •, oil fed with gasoline;

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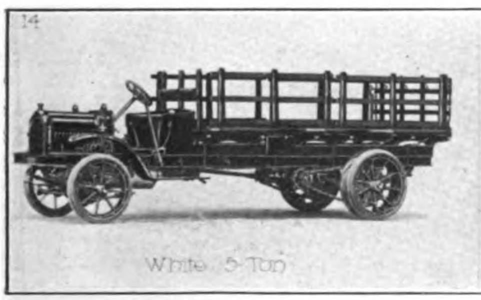
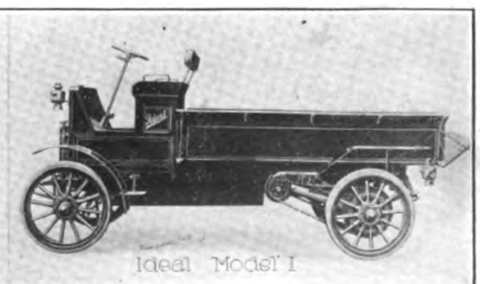


White 5-Ton

Vulcan 7-Ton



Ideal Model I

15

K-R-I-T Model K-D — Pope-Hartford 3-Ton — Stewart 1500-Pound

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication. Splash
Mais Motor Truck, Mais Motor Truck Co.	—		3000	4	4	5.25	1090	26	×	—	×
Mais Motor Truck, Mais Motor Truck Co.	—		3000	4	4	5.25	1090	26	×	—	×
Moeller, New Haven Truck & Auto Works	D		3000	4	4.25	4.75	1000	30	×	—	—
Monitor, Monitor Automobile Works	E		3000	4	3.75	5.25	1200	30	×	—	—
Nyberg, Nyberg Automobile Works	1913		3000	4	3.75	5.25	1800	22.5	×	—	×
Reo, Reo Motor Truck Co.	J		3500	4	4	4.5	1200	26.4	×	—	—
Sandusky, Sandusky Auto Parts & Motor Truck Co.	C		3000	4	3.75	5	1200	22.5	×	—	—
Schacht, Schacht Motor Car Co.	15		3500	4	4.25	5.5	1200	50	×	—	—
Service, Service Motor Car Co.	M		3000	4	4.125	5.5	....	28.9	×	—	—
Tulsa, Tulsa Automobile & Mfg. Co.	—		3000	4	4.125	5.25	....	45	×	—	—
Walter, Walter Motor Truck Co.	—		3000	4	4	5	....	25.6	×	—	—
Walter, Walter Motor Truck Co.	—		3000	4	4	5	....	25.6	×	—	—
White, The White Co.	GTB		3000	4	3.75	5.125	....	30	×	—	—

GASOLINE SERVICE WAGONS OF CAPACIT

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication. Splash
Adams, The Adams Bros. Co.	E		4000	4	3.875	5	1200	30	×	—	—
Alco, American Locomotive Co.	1		4000	4	4.5	5.5	1000	30	×	—	—

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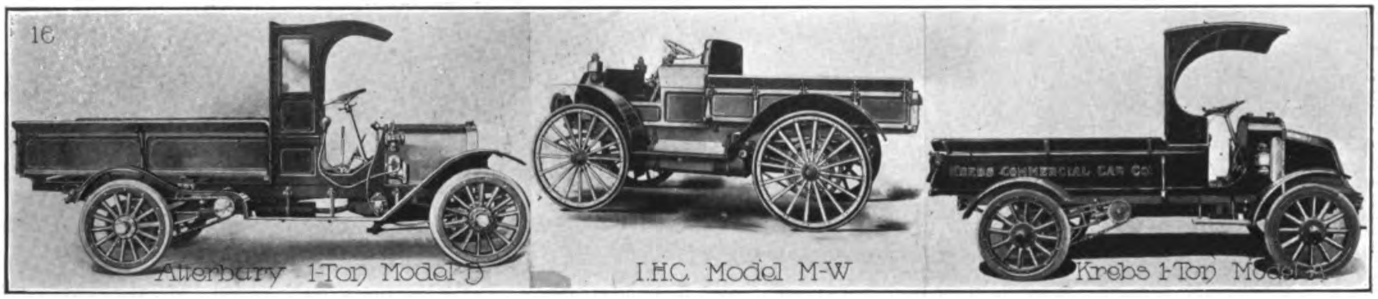

Atterbury 1-Ton Model D — I.H.C. Model M-W — Krebs 1-Ton Model

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication. Splash
Avery, Avery Co.		A	4000	4	4.75	5	1200	45	×	—	×
Avery, Avery Co.		B	4000	4	4.75	5	1200	45	×	—	×
Brennan, Brennan Motor Mfg. Co.	—		4000	4	4	5	1000	25.5	×	—	—
Cass Motor Truck, Cass Motor Truck Co.	1912		4000	4	4.5	2	1000	29	×	—	×
Cass Motor Truck, Cass Motor Truck Co.	1912		4000	4	4.5	2	1000	29	×	—	×
Coleman, Coleman Motor Truck Co.	C		4000	4	3.75	5.25	....	....	×	—	—
De Dion-Bouton, De Dion-Bouton Selling Branch	C. V.		4000	4	3	5.25	1500	14	×	—	—
Dorris, Dorris Motor Car Co.	H 13		4000	4	4.375	5	1000	30.6	×	—	—
Dorris, Dorris Motor Car Co.	H 13		4000	4	4.375	5	1000	30.6	×	—	—
Durable Dayton, Dayton Auto Truck Co.	H		4000	4	4.25	5	....	35	×	—	—
Garford, Garford Co.	76		4000	4	4.625	6	1500	34.2	×	—	—
G. M. C., General Motors Truck Co.	SC		4000	4	4	6	950	25.6	×	—	—
Gramm, Gramm Motor Truck Co.	2		4000	4	4.25	4.5	1150	28.9	×	—	×
B. A. Gramm's Truck, Gramm-Bernstein Co.	—		4000	4	4.5	5.5	1000	29	×	—	—
Ideal, Ideal Auto Co.	G		4000	4	4.125	5.25	1000	26	×	—	—
Juno, Juno Motor Truck Co.	—		4000	4	4.25	5	850	31	×	—	—
Kato, Four Traction Auto Co.	G		4000	4	4.25	4.5	1000	31	×	—	×
KisselKar Truck, Kissel Motor Car Co.	—		4000	4	4.5	5.25	....	40	×	—	—
Knox, Knox Automobile Co.	R-3		4000	4	5	5.5	850	40	×	—	—
Lambert, Buckeye Mfg. Co.	—		4000	4	4.5	5	....	32.4	×	—	—
Lauth-Juergens, Lauth-Juergens Motor Car Co.	L		4000	4	3.75	5.25	1200	35	×	—	—
Mack, International Motor Co.		I	4000	4	4.5	5.5	1000	29.6	×	—	—
Mack, International Motor Co.		I	4000	4	4.5	5.5	1000	29.6	×	—	—

Axles—1, tubular; 2, I section; 3, rectangular; 4, solid forging; 5, dead; 6, semi-floating; 7, three-quarter floating; 8, full steel; 3, armored wood. Clutch—1, cone; 2, contracting band; 3, expanding band; 4, multiple disc; 5, disc; 6, friction; 7, plane- ‡, double grooved roller friction drive; **, gravity; ¶, steel.

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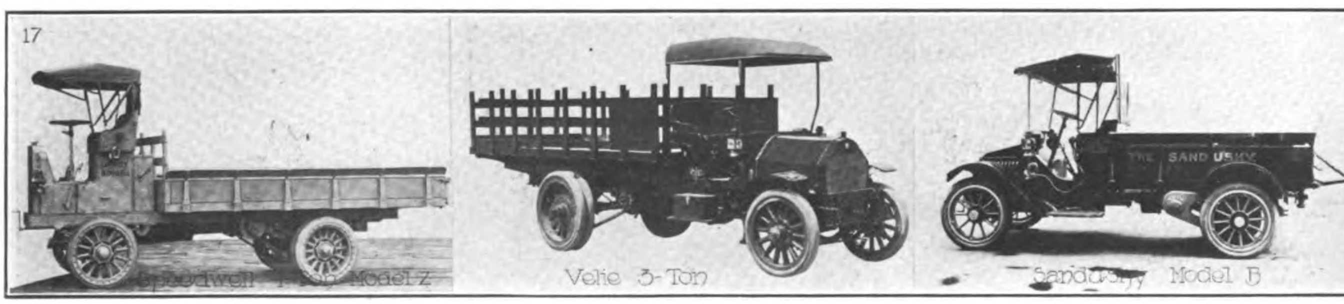

Speedwell Model Z — Velie 3-Ton — Sandusky Model B

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Crown 1½-Ton Model C — Harder Model C — Wichita 1-Ton

Lubrication, Force Feed	Lubrication, Combination	Ignition Magneto	Ignition, Battery	Clutch	Speed Ratio Forward	Speed Ratio, Reverse	Wheelbase, Inches	Drive, Shaft	Drive, Chain	Drive, Double Chain	Friction Drive.	Frame Material	Springs Front	Rear	Axles, Front	Axles, Rear	Brakes	Tires, Front	Tires, Rear	Drive, Right	Drive, Left	Price
—	—	×	—	3	3	1	119	†	—	—	—	2	44x2.5	52x2.5	1	5	3	36x4	36x5	—	×	2,750.00
—	—	×	—	3	3	1	132	†	—	—	—	2	44x2.5	52x2.5	1	5	3	36x4	36x5	—	×	2,800.00
×	—	×	—	4	3	1	120	—	—	×	—	2	47x2.5	52x3	2	4	2	36x4	36x5	×	—	2,500.00
—	×	×	—	1	3	1	116	—	—	×	—	2	40x2.5	52x2.5	2	3	1	36x3.5	36x4	×	—	1,850.00
—	—	×	—	4	3	1	124	—	—	×	—	2	40x2.5	44x2.5	2	5	2	34x3	36x3	..	..	......
—	×	×	—	4	3	1	130	—	—	×	—	2	......	......	4	4	2	36x4	36x3	—	×	1,800.00
×	—	×	—	1	3	1	106	—	—	×	—	2	40x2	40x2	3	5	2	36	40	—	×	2,350.00
×	—	×	—	1	3	1	138	=	—	—	—	2	......	......	2	8	1	......	......	—	×	2,300.00
×	—	×	—	6	..	..	130	—	—	×	—	..	......	......	4	3	1	34x3.5	34x4	—	×	1,750.00
×	—	×	—	1	3	1	132	—	—	×	—	2	38x2	48x2	2	5	1	36x3.5	36x3	×	—	2,200.00
×	—	×	—	1	3	1	120	—	—	×	—	2	44x2.5	50x2.5	4	4	1	36x4	36x5	×	—	2,800.00
×	—	×	—	1	3	1	144	—	—	×	—	2	44x2.5	50x2.5	4	4	1	36x4	36x5	×	—	2,800.00
—	×	×	—	1	4	1	144	×	—	—	—	2	......	......	2	8	1	36x4.5	36x4.5	×	—	3,000.00

IES RANGING FROM 4000 TO 5000 POUNDS.

—	×	×	—	4	3	1	140	—	—	×	—	2	44x2.5	50x2.5	2	3	2	36x4	36x3.5	..	..	......
—	×	×	—	4	3	1	112	—	×	—	—	2	47x3	54x3	2	4	2	36x4	36x3	..	..	2,950.00

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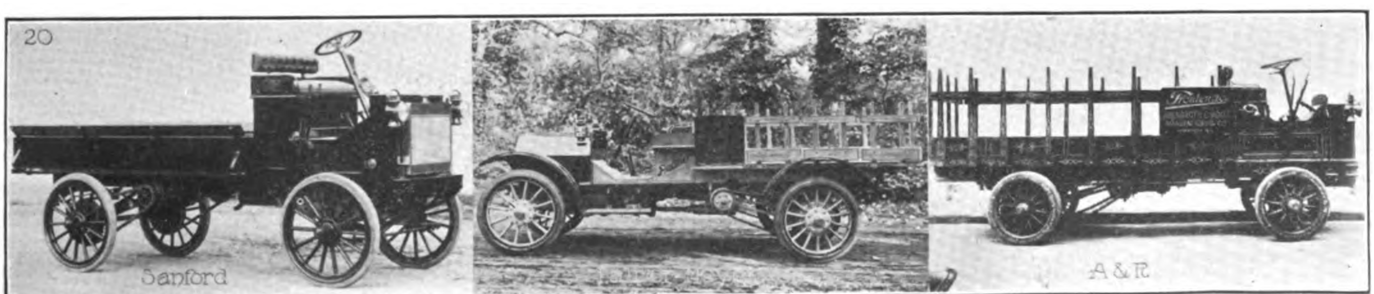
Babcock Model — Stearns 5-Ton — Franklin

—	—	×	—	5	3	1	140	—	—	×	—	2	40x2.5	40x3	4	4	2	......	......	..	..	2,700.00
—	—	×	—	5	3	1	128	—	—	×	—	2	40x2.5	45x3	4	4	2	......	......	..	..	2,700.00
×	—	×	—	1	3	1	128	—	—	×	—	2	45x3	50x3	2	2	2	36x3.5	36x3	×	—	3,000.00
—	—	×	—	1	4	1	130	—	×	—	—	2	48x2.5	62x3	4	4	1	34x3.5	38x3.5	×	—	2,650.00
—	—	×	—	1	4	1	154	—	×	—	—	2	48x2.5	62x3	4	4	1	34x3.5	38x3.5	×	—	2,650.00
—	×	×	—	1	3	1	107	—	—	×	—	2	40x2.5	40x2.5	2	2	2	36x4	36x3	×	—	2,400.00
×	—	×	—	4	3	1	136	×	—	—	—	3	45x3	55x3	2	8	3	32x4	36x3.5	×	—	......
—	×	×	—	4	3	1	138	—	—	×	—	2	42x2.5	50x2.5	2	3	2	34x3.5	36x3.5	×	—	2,500.00
—	×	×	—	4	3	1	163	—	—	×	—	2	42x2.5	50x2.5	2	3	2	34x3.5	36x3.5	×	—	2,500.00
×	—	×	×	4	3	1	120	×	—	—	—	2	......	......	2	3	2	36x4	36x3	—	×	2,650.00
—	×	×	—	1	3	1	136	—	—	×	—	2	......	......	4	5	1	36x4	40x3.5	×	—	......
—	×	×	—	1	3	1	142	—	—	×	—	2	40	48	2	3	1	34x4	36x3.5	—	×	2,750.00
—	—	×	—	4	3	1	116	—	—	×	—	2	44.5x2.5	42.5x2.5	3	5	2	36x4	36x3	×	—	2,600.00
—	×	—	×	4	3	1	128	—	—	×	—	2	40x2.5	52x2.5	2	3	2	36x4	36x3.5	×	—	2,750.00
—	×	×	—	1	3	1	124	—	—	×	—	2	40x2.5	40x2.5	2	3	2	36x4	36x5	×	—	2,250.00
×	—	×	—	4	3	1	132	—	—	×	—	2	40x2.5	44x2.5	4	4	2	36x4	36x3.5	×	—	2,800.00
—	—	×	×	1	3	1	120	×	—	—	—	2	40x2.25	......	1	8	3	34x3	34x3	×	—	......
—	×	×	—	1	4	1	140	—	—	×	—	2	38x2.5	54x2.5	2	5	2	34x4	36x3.5	×	—	2,750.00
×	—	×	—	4	3	1	145	—	—	×	—	2	42x2	54x2.5	2	4	2	34x4	34x4	×	—	3,000.00
—	×	×	—	6	..	..	120	—	—	—	×	2	44x2.5	48x2.5	2	2	2	36x3.5	36x4	×	—	2,300.00
—	×	×	—	4	3	1	120	—	—	×	—	2	42x3	52x3	2	3	2	36x4	36x3.5	×	—	2,800.00
×	—	×	—	4	3	1	126	—	—	×	—	2	44x2.5	44x2.5	3	3	2	36x4	36x3.5	×	—	3,000.00
×	—	×	—	4	3	1	162	—	—	×	—	2	44x2.5	44x2.5	3	3	2	36x4	36x3.5	×	—	3,000.00

floating. Brakes—1, rear wheels; 2, jackshaft and rear wheels; 3, propellor shaft and rear wheels. Frame—1, wood; 2
tary transmission; 8, multiple cone. Symbols—×, yes; —, no; =, worm drive; †, concentric gearing; *, oil fed with gasoline;



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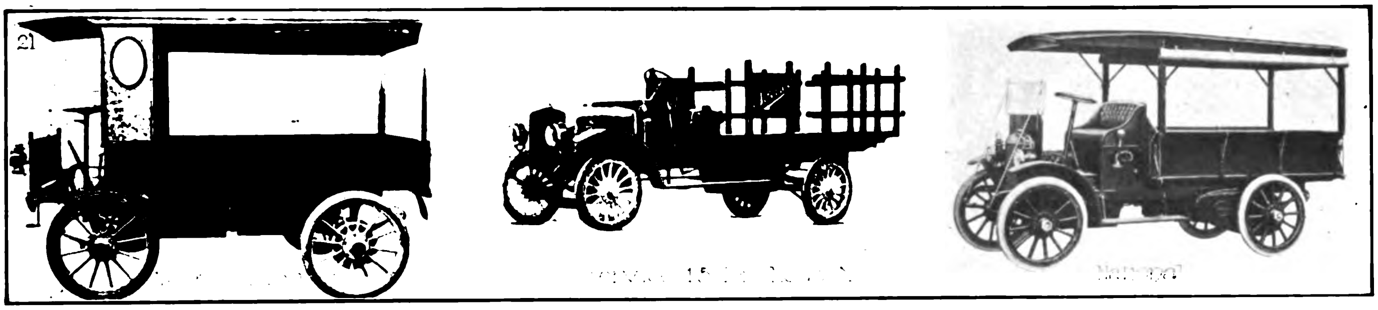
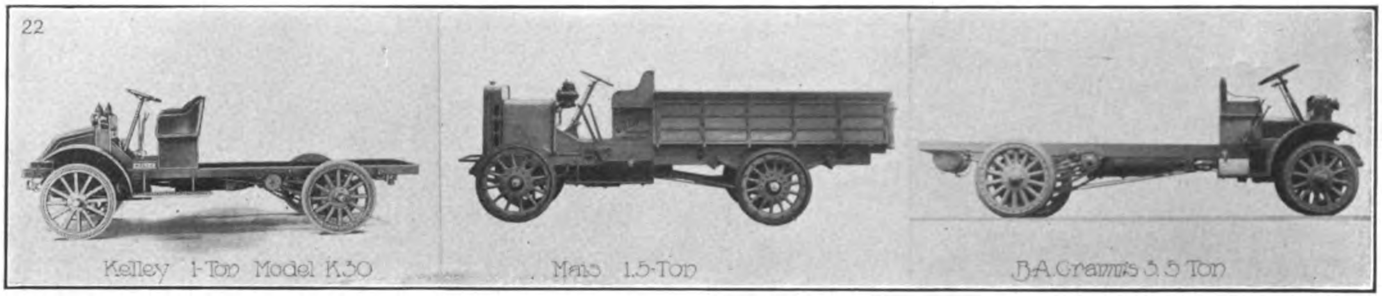
Sanford — A & R



Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Mais Motor Truck, Mais Motor Truck Co.	—		4000	4	4	5.25	1000	26	×	—	×
Mais Motor Truck, Mais Motor Truck Co.	—		4000	4	4	5.25	1000	26	×	—	×
Martin, Martin Carriage Works	E		4000	4	4.25	5	900	28.9	×	—	—
Moreland, Moreland Motor Truck Co.	E		4000	4	4.125	5.25	....	27.2	×	—	—
Moreland, Moreland Motor Truck Co.	E		4000	4	4.125	5.25	....	27.2	×	—	—
Packers, Packers Motor Truck Co.	D		4000	4	4.25	4.5	1000	28.9	×	—	—
Plymouth, Plymouth Motor Truck Co.	G-2		4000	4	4.75	5	900	35	×	—	×
Practical Piggins, Piggins Motor Truck Co.	—		4000	4	4.75	5	1000	40	×	—	—
Randolph, Randolph Motor Truck Co.	N		4000	4	4.125	5.25	1000	27.25	×	—	—
Randolph, Randolph Motor Truck Co.	N		4000	4	4.125	5.25	1000	27.25	×	—	—
Rowe, Rowe Motor Mfg. Co.	D		4000	4	4.75	5.5	....	45	×	—	—
Stanley Steamer, Stanley Motor Carriage Co.	—		4000	2	4.5	6.5	....	30	..	..	—
Stegeman, Stegeman Motor Car Co.	—		4000	4	4.125	5.25	1200	35	×	—	—
Sternberg, Sternberg Mfg. Co.	1913		4000	4	4.25	6.75	809	28.9	×	—	×
Toledo Truck, Toledo Motor Truck Co.	B		4000	4	4.5	5.5	1200	40	×	—	×
Transit, Transit Motor Truck Co.	F		4000	4	3.75	5.25	1200	22.5	×	—	×

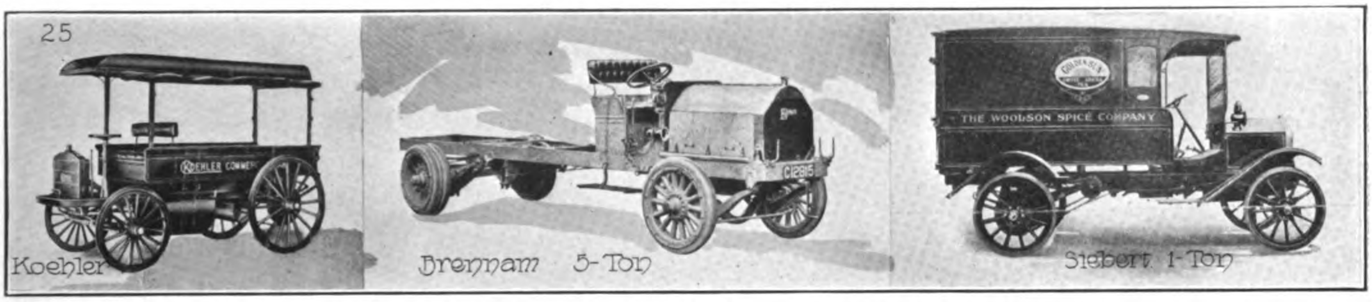


Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Universal, Universal Motor Truck Co.	—		4000	4	4	5.5	1123	36	×	—	—
U. S., United States Motor Truck Co.	E		4000	4	4.125	5.25	1143	27.25	×	—	—
Velie, Velie Motor Vehicle Co.	Y		4000	4	4.5	5.5	1100	32.6	×	—	×
Velie, Velie Motor Vehicle Co.	Y		4000	4	4.5	5.5	1100	32.6	×	—	×
Walter, Walter Motor Truck Co.	—		4000	4	4	5	....	25.6	×	—	—
Walter, Walter Motor Truck Co.	—		4000	4	4	5	....	25.6	×	—	—
Wichita, Wichita Falls Motor Co.	B		4000	4	3.5	5	1000	19	×	..	—
Wilcox, Wilcox Motor Car Co., H. E.	2		4000	4	4.25	4.5	....	26.9	×	—	×
Willet, Willet Engine & Truck Co.	L		4000	4	4.5	5	800	32.6	×	—	..
GASOLINE SERVICE WAGONS OF CAPACIT											
Blair, Blair Mfg. Co.	D		5000	4	4.5	5.5	....	40	×	—	—
Blair, Blair Mfg. Co.	D		5000	4	4.5	5.5	....	40	×	—	—
Four Wheel Drive, Four Wheel Drive Auto Co.	B		5500	4	4.75	5.5	1000	36.1	×	—	—
Mais Motor Truck, Mais Motor Truck Co.	—		5000	4	4	5.25	900	26	×	—	×
Mais Motor Truck, Mais Motor Truck Co.	—		5000	4	4	5.25	900	26	×	—	×
GASOLINE SERVICE WAGONS OF CAPACIT											
A & R, Abendroth & Root Mfg. Co.	—		6000	4	5	5.75	800	40	×	—	—
Avery, Avery Co.		A	6000	4	4.75	5	1200	45	×	—	×
Avery, Avery Co.		B	6000	4	4.75	5	1200	45	×	—	×

Axles—1, tubular; 2, I section; 3, rectangular; 4, solid forging; 5, dead; 6, semi-floating; 7, three-quarter floating; 8, full steel; 3, armored wood. Clutch—1, cone; 2, contracting band; 3, expanding band; 4, multiple disc; 5, disc; 6, friction; 7, plane- ‡, double grooved roller friction drive; **, gravity; ¶, steel.

24 Knickerbocker 5-Ton Mercury Model Aries 7-Ton

Lubrication, Force Feed	Lubrication, Combination	Ignition Magneto	Ignition, Battery	Clutch	Speed Ratio Forward	Speed Ratio, Reverse	Wheelbase, Inches	Drive, Shaft	Drive, Chain	Drive, Double Chain	Friction Drive.	Frame Material	Springs Front	Rear	Axles, Front	Axles, Rear	Brakes	Tires, Front	Tires, Rear	Drive, Right	Drive, Left	Price
—	—	×	—	3	3	1	132	×	—	—	—	2	44x2.5	52x2.5	1	4	3	36x4	36x4	—	×	2,950.00
—	—	×	—	3	3	1	145	×	—	—	—	2	44x2.5	52x2.5	1	4	3	36x4	36x4	—	×	3,000.00
×	—	×	×	4	3	1	130	—	—	×	—	3	42x2.75	48x2.75	2	3	2	36x4	40x3.5	×	—	2,850.00
—	×	×	—	1	3	1	120	—	—	×	—	2	44x2.5	48x2.5	2	5	2	34x4	34x3.5	×	—	......
—	×	×	—	1	3	1	144	—	—	×	—	2	44x2.5	48x2.5	2	5	2	34x4	34x3.5	×	—	......
—	×	×	—	4	3	1	130	—	—	×	—	2	46x2.5	48x2.5	2	3	2	36x3.5	36x5	×	—	2,675.00
—	—	×	—	6	..	..	126	—	—	×	—	2	38x2	48x2	2	5	1	36x5	36x6	—	×	2,600.00
×	—	×	—	1	3	1	120	†	—	—	—	2	40x3	44x3	2	5	3	36x5	36x5	..	..	2,750.00
×	—	×	—	1	3	1	125	—	—	×	—	2	44x3	48x3	2	3	1	36x4	38x5	..	..	2,250.00
×	—	×	—	1	3	1	144	—	—	×	—	2	44x3	48x3	2	3	1	36x4	38x5	..	..	2,250.00
×	—	×	—	4	3	1	144	—	—	×	—	2	44x2.5	44x2.5	2	3	1	36x4	36x3.5	×	—	3,300.00
×	—	..	..	..	..	..	144	..	..	..	..	1	35x2.12	33x2.12	1	1	1	36x6	36x6	×	—	......
—	×	×	—	4	3	1	140	—	—	×	—	2	42x2.5	50x2.5	2	3	3	34x3.5	36x3.5	—	×	2,950.00
—	—	×	—	4	3	1	...	—	—	×	—	3	38x2.25	44x3.5	2	4	2	34x4	36x5	×	—	2,800.00
—	—	×	—	1	3	1	130	—	—	×	—	2	38x2.5	42x2.5	2	5	2	36x4	36x3	×	—	2,400.00
—	—	×	—	5	3	1	144	—	—	×	—	2	48x3	50x3	2	5	2	36x4	36x3.5	×	—	2,850.00



25 Koehler Brennam 5-Ton Siebert 1-Ton

—	×	×	—	4	3	1	132	—	—	×	—	2	46x3	52x3	2	3	3	36x4	36x3	×	—	2,750.00
×	—	×	×	1	3	1	132	—	—	×	—	2	44x2.5	48x2.5	2	4	2	34x3.5	36x3.5	—	×	2,800.00
—	—	×	—	4	3	1	148	—	—	×	—	2	40x2.5	49x3	2	4	2	36x3.5	36x4	×	—	2,850.00
—	—	×	—	4	3	1	172	—	—	×	—	2	40x2.5	49x3	2	4	2	36x3.5	36x4	×	—	2,850.00
×	—	×	—	1	3	1	132	—	—	×	—	2	44x2.5	50x2.5	4	4	1	36x5	36x3.5	×	—	3,000.00
×	—	×	—	1	3	1	156	—	—	×	—	2	44x2.5	50x2.5	4	4	1	36x5	36x3.5	×	—	3,000.00
—	×	×	—	1	3	1	118	—	—	×	—	2	40x2.25	44x2.5	2	3	2	34x3.5	34x3	×	—	2,100.00
—	—	×	—	1	3	1	117	—	—	×	—	2	......	......	2	5	2	36x3.5	36x4	..	..	2,500.00
*	..	×	—	1	3	1	144	—	—	×	—	2	40x2.5	48x3	2	3	2	36x4	36x3.5	—	×	2,850.00

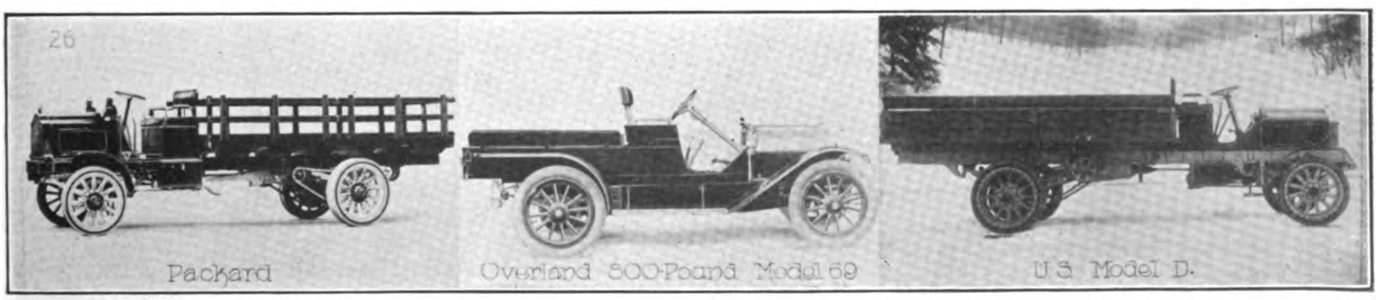
IES RANGING FROM 5000 TO 6000 POUNDS.

—	×	×	—	1	3	1	121	=	—	—	—	2	40x2.5	52x2.5	2	8	3	34x4	36x3.5	×	—	3,250.00
—	×	×	—	1	3	1	144	=	—	—	—	2	40x2.5	52x2.5	2	8	3	34x4	36x3.5	×	—	3,250.00
×	—	×	—	4	3	1	125	×	—	—	—	2	42x2.5	44x2.5	8	8	3	36x5	36x5	×	×	4,000.00
—	—	×	—	3	3	1	145	×	—	—	—	2	44x2.5	52x2.5	1	5	3	36x4	36x4	—	×	3,200.00
—	—	×	—	3	3	1	160	×	—	—	—	2	44x2.5	52x2.5	1	5	3	36x4	36x4	—	×	3,200.00

IES RANGING FROM 6000 TO 7000 POUNDS.

—	×	×	×	1	3	1	122	—	—	×	—	2	48x3	50x3	2	5	2	36x5.	36x4	×	—	3,500.00
—	—	×	—	5	3	1	140	—	—	×	—	2	40x3	40x3	4	4	2	......	......	..	..	3,200.00
—	—	×	—	5	3	1	128	—	—	×	—	2	40x2.5	48x3	2	4	2	......	......	..	..	3,200.00

floating. Brakes—1. rear wheels; 2, jackshaft and rear wheels; 3. propellor shaft and rear wheels. Frame—1, wood; 2, tary transmission, 8, multiple cone. Symbols—×, yes; —, no; =, worm drive; †, concentric gearing; *, oil fed with gasoline;


26 Packard Overland 800-Pound Model 69 U.S. Model D.

Superior 1-Ton
Saurer 4.5-Ton
Plymouth 2-Ton

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P. S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Brennan, Brennan Motor Mfg. Co.	—		6000	4	4.5	5	1000	32.5	×	—	—
Clark, Edward S. Clark	—		6000	4	4.125	5.25	1000	35	×	—	—
Clark, Edward S. Clark	—		6000	4	4.125	5.25	1000	35	×	—	—
Durable Dayton, Dayton Auto Truck Co.	K		6000	4	4.75	5.5	....	45	×	—	—
Gramm, Gramm Motor Truck Co.	3		6000	4	5	5	960	40	×	—	×
Juno, Juno Motor Truck Co.	—		6000	4	4.75	5.5	850	42	×	—	—
Kato, The Four Traction Auto Co.	H		6000	4	4.75	5	1000	36	×	—	×
Kelly, The Kelly-Springfield Motor Truck Co.	K 40		6000	4	4.5	6.5	900	38	×	—	—
KisselKar Truck, Kissel Motor Car Co.	—		6000	4	4.875	5	....	50	×	—	—
Knox, Knox Automobile Co.	R-15		6000	4	5	5.5	850	40	×	—	—
Lauth-Juergens, Lauth-Juergens Motor Car Co.	M		6000	4	4.75	5	1200	45	×	—	—
Lord Baltimore, Lord Baltimore Motor Car Co.	A		6000	4	4.75	5.5	1000	36.1	×	—	—
Martin, Martin Carriage Works	L		6000	4	4.75	5.5	850	36.1	×	—	—
Moeller, New Haven Truck & Auto Works	C		6000	4	4.5	5	1000	32.3	×	—	—
Moreland, Moreland Motor Truck Co.	13F		6000	4	4.5	5.5	....	32.4	×	—	—
Moreland, Moreland Motor Truck Co.	13F		6000	4	4.5	5.5	....	32.4	×	—	—
Packard, Packard Motor Car Co.	—		6000	4	4.5	5.5	1000	32	×	—	×
Peerless Motor Truck, Peerless Motor Car Co.	—		6000	4	4.5	6.5	925	32.4	×	—	×
Peerless Motor Truck, Peerless Motor Car Co.	—		6000	4	4.5	6.5	925	32.4	×	—	×
Pope-Hartford, Pope Mfg. Co.	—		6000	4	....	....	....	50	×	—	—
Pope-Hartford, Pope Mfg. Co.	—		6000	4	....	....	....	50	×	—	—
Practical Piggins, Piggins Motor Truck Co.	—		6000	4	4.75	5	1000	40	×	—	—
Schacht, Schacht Motor Car Co.	19		6000	4	4.25	5.5	1200	50	×	—	—
Standard, Standard Motor Truck Co.	—		6000	4	4.5	5.5	1000	40	×	—	—
Standard, Standard Motor Truck Co.	—		6000	4	4.5	5.5	1000	40	×	—	—
Standard, Standard Motor Truck Co.	—		6000	4	4.5	5.5	1000	40	×	—	—
Standard, Standard Motor Truck Co.	—		6000	4	4.5	5.5	1000	40	×	—	—
Sternberg, Sternberg Mfg. Co.	1913		6000	4	4.25	6.75	796	28.9	×	—	×
Universal, Universal Motor Truck Co.	—		6000	4	4	5.5	1000	36	×	—	—
Universal, Universal Motor Truck Co.	—		6000	4	4	5.5	1000	36	×	—	—
U. S., United States Motor Truck Co.	D		6000	4	4.5	5.5	1092	32.4	×	—	—
Velie, Velie Motor Vehicle Co.	Z		6000	4	4.5	5.5	1100	32.6	×	—	×
Velie, Velie Motor Vehicle Co.	Z		6000	4	4.5	5.5	1100	32.6	×	—	×
Victor, Victor Motor Truck Co.	—		6000	4	4.875	5.5	1000	50	×	—	—
Walter, Walter Motor Truck Co.	—		6000	4	4	5	....	25.6	×	—	—
Walter, Walter Motor Truck Co.	—		6000	4	4	5	....	25.6	×	—	—
White, The White Co.	GTA		6000	4	3.75	5.125	....	30	×	—	—
Wilcox Trux, H. E. Wilcox Motor Car Co.	—		6000	4	4.25	4.5	1200	26.9	×	—	×

GASOLINE SERVICE WAGONS OF CAPACIT

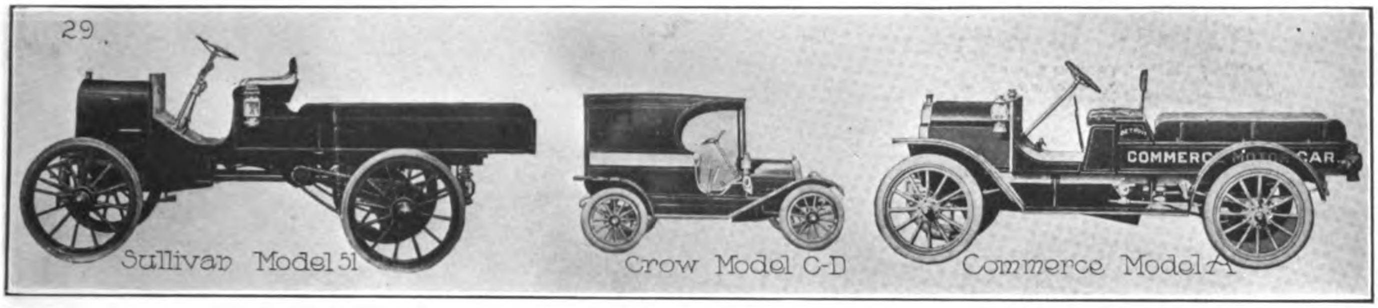
Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P. S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Alco, American Locomotive Co.	6		7000	4	5	6	850	36	×	—	—
Blair, Blair Mfg. Co.	E		7000	4	4.5	5.5	....	40	×	—	—
Blair, Blair Mfg. Co.	E		7000	4	4.5	5.5	....	40	×	—	—
Garford, Garford Co.	77		7000	4	4.625	6	1500	34.2	×	—	—
G. M. C., General Motors Co.	H		7000	4	5	5	800	40	×	—	—
B. A. Gramm's Trucks, Gramm-Bernstein Co.	—		7000	4	4.5	5.5	1000	32	×	—	—
King, A. R. King Mfg. Co.	—		7000	4	4.5	5.5	1200	32.4	×	—	—
Knickerbocker, Knickerbocker Motor Truck Mfg. Co.	12-3		7000	4	4.5	5	1000	32.4	×	—	×
Smith-Milwaukee, A. O. Smith Co.	A		7000	4	5	5.75	900	40	×	—	×
Transit, Transit Motor Truck Co.	T		7000	4	4.5	5	1202	32.4	×	—	×
Walter, Walter Motor Truck Co.	—		7000	4	4.5	6	....	32.1	×	—	—
Walter, Walter Motor Truck Co.	—		7000	4	4.5	6	....	32.1	×	—	—

GASOLINE SERVICE WAGONS OF CAPACIT

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P. S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
A & R, Abendroth & Root Mfg. Co.	—		8000	4	5	5.75	800	40	×	—	—
KisselKar Truck, Kissel Motor Car Co.	—		8000	4	4.875	5	....	50	×	—	—
Knickerbocker, Knickerbocker Motor Truck Mfg. Co.	12-4		8000	4	4.5	5	1000	32.4	×	—	×

Axles—1. tubular; 2. I section; 3. rectangular; 4. solid forging; 5. dead; 6. semi-floating; 7. three-quarter floating; 8. full steel; 3. armored wood. Clutch—1. cone; 2. contracting band; 3. expanding band; 4. multiple disc. 5. disc; 6. friction; 7 plane- ‡. double grooved roller friction drive. **. gravity; §. steel.

Brooks
Peerless 4-Ton
De Dion-Bouton 5-Ton



29 Sullivan Model 51 Crow Model C-D Commerce Model A

Lubrication, Force Feed	Lubrication, Combination	Ignition Magneto	Ignition, Battery	Clutch	Speed Ratio Forward	Speed Ratio, Reverse	Wheelbase, Inches	Drive, Shaft	Drive, Chain	Drive, Double Chain	Friction Drive.	Frame Material	Springs Front	Rear	Axles, Front	Axles, Rear	Brakes	Tires, Front	Tires, Rear	Drive, Right	Drive, Left	Price
×	—	×	—	1	8	1	132	—	—	×	—	2	45x3	50x3	2	2	2	36x4	36x4	×	—	3,500.00
—	×	×	—	1	3	1	120	—	—	×	—	2	44x3	52x3	2	3	2	36x5	36x4	—	×	3,400.00
—	×	×	—	1	3	1	130	—	—	×	—	2	44x3	52x3	2	3	2	36x5	36x4	—	×	3,400.00
×	—	×	—	4	3	1	136	×	—	—	—	2	......	......	2	3	2	36x5	36x4	—	×	3,400.00
—	—	×	—	4	4	1	124	—	—	×	—	2	40x3.5	46.12x3.5	3	5	2	36x5	36x4	×	—	3,500.00
×	—	×	—	4	3	1	143	—	—	×	—	2	41x3	44x3	4	4	2	36x5	36x4	×	—	3,400.00
—	—	×	×	1	3	1	144	×	—	—	—	2	44x2.75	44x2.75	1	8	2	34x5	34x5	×	—	3,500.00
×	—	×	—	1	3	1	150	—	—	×	—	2	48x3	56x3	2	2	1	38x5	42x5	—	×	3,400.00
—	×	×	—	1	4	1	144	—	—	×	—	2	46x3	52x3	1	5	2	36x4	36x4	×	—	3,350.00
×	—	×	—	4	3	1	149	—	—	×	—	2	48x2.5	58x2.5	2	4	2	36x5	36x5	×	—	3,700.00
×	—	..	..	4	4	1	120	—	—	×	—	2	42x3	52x3.5	2	3	2	38x5	38x4	×	—	3,450.00
×	—	×	—	1	3	1	130	—	—	×	—	2	36x3	56x3	3	5	2	34x4	38x4	—	×	3,250.00
×	—	×	×	4	3	1	142	—	—	×	—	3	42x3.5	56x3.5	2	3	2	36x5	40x4	×	—	3,500.00
×	—	×	—	4	3	1	126	—	—	×	—	2	47x2.75	52x3	2	5	2	36x5	36x4	×	—	3,400.00
—	×	×	—	1	3	1	144	—	—	×	—	2	46x3	48x3	2	5	2	36x5	36x5	×	—	......
—	×	×	—	1	3	1	168	—	—	×	—	2	46x3	48x3	2	5	2	36x5	36x5	×	—	......
—	—	×	—	4	3	1	144	—	—	×	—	2	46	51.5	3	3	2	36x4	36x5	×	—	3,400.00
—	—	×	—	1	4	1	151	—	—	×	—	2	40.87x3	56.25x3	2	2	2	36x4	40x4	×	—	3,700.00
—	—	×	—	3	4	1	174	—	—	×	—	2	......	......	..	4	2	36x4	40x4	×	—	3,700.00
×	—	×	—	1	4	1	138	—	—	×	—	2	44	50	2	4	2	36x6	36x4	—	×	3,350.00
×	—	×	—	1	4	1	160	—	—	×	—	2	44	50	2	4	2	36x6	36x4	—	×	3475.00
×	—	×	—	1	3	1	135	†	—	—	—	2	40x3	44x3	2	5	3	36x6	36x4	..	..	3,000.00
×	—	×	—	1	3	1	144	—	—	×	—	2	40x2.5	50x3	2	5	2	36x4	36x4	—	×	3,100.00
×	—	×	—	4	3	1	120	—	—	×	—	2	45x2.5	52x3.5	2	3	2	36x5	36x5	—	×	2,750.00
×	—	×	—	4	3	1	144	—	—	×	—	2	45x2.5	52x3.5	2	3	2	36x5	36x5	—	×	2,750.00
×	—	×	—	4	3	1	168	—	—	×	—	2	45x2.5	52x3.5	2	3	2	36x5	36x5	—	×	2,800.00
×	—	×	—	4	3	1	192	—	—	×	—	2	45x2.5	52x3.5	2	3	2	36x5	36x5	—	×	2,800.00
—	—	×	—	4	3	1	140	—	—	×	—	3	48x3	52x3	2	4	2	36x4	40x4	×	—	3,400.00
—	×	×	—	4	3	1	132	—	—	×	—	2	46x3	52x3	2	3	3	36x5	36x4	×	—	3,400.00
—	×	×	—	4	3	1	150	—	—	×	—	2	46x3	52x3	2	3	3	36x5	36x4	×	—	3,400.00
×	—	×	×	1	3	1	144	—	—	×	—	2	48x3	52x3	2	3	2	34x5	36x5	—	×	3,500.00
—	—	×	—	4	3	1	148	—	—	×	—	2	40x2.5	44x3	2	1	2	36x5	40x5	×	—	3.350.00
—	—	×	—	4	3	1	172	—	—	×	—	2	40x2.5	44x3	2	1	2	36x5	40x5	×	—	3,350.00
—	×	×	—	1	3	1	146	—	—	×	—	2	45x2.5	52x3	2	3	2	36x5	36x4	..	..	2,750.00
×	—	×	—	1	3	1	156	—	—	×	—	2	46x2.5	56x3	4	4	1	36x5	38x5	×	—	3,400.00
×	—	×	—	1	3	1	180	—	—	×	—	2	46x2.5	56x3	4	4	1	36x5	38x5	×	—	3,400.00
—	×	×	—	1	4	1	162	—	—	×	—	2	......	......	3	5	2	36x5	40x4	×	—	3,700.00
—	—	×	—	1	3	1	126	—	—	×	—	2	......	......	2	..	2	36x4	36x3.5	..	..	3,250.00

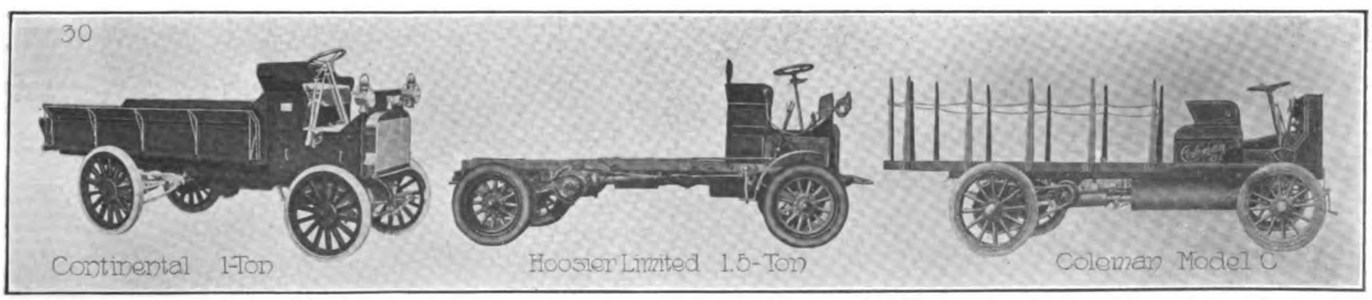
IES RANGING FROM 7000 TO 8000 POUNDS.

—	×	×	—	4	3	1	125	—	—	×	—	2	47x3	54x3	2	4	3	36x5	36x4	..	..	3,650.00
—	×	×	—	1	3	1	130	=	—	—	—	2	40x2.5	52x3	2	8	3	36x5	36x4	×	—	3,750.00
—	×	×	—	1	3	1	144	=	—	—	—	2	40x2.5	52x3	2	8	3	36x5	36x4	×	—	3,750.00
—	×	×	—	1	3	1	136	—	—	×	—	2	......	......	4	5	1	36x5	40x4	×	—	......
—	×	×	—	4	3	1	138	—	—	×	—	2	47x3	56x3	2	5	2	36x5	36x4	×	—	3,500.00
—	×	..	..	4	4	1	140	—	—	×	—	2	40x3	52x3	2	3	2	36x5	36x5	×	—	3,600.00
—	×	×	—	4	3	1	120	—	—	×	—	2	44.5x3	54x3	2	5	2	36x6	36x4	×	—	3,350.00
—	—	×	—	1	3	1	...	—	—	×	—	2	42.5x3	49x3	2	3	2	36x5	36x5	—	×	3,500.00
—	—	×	—	4	3	1	168	=	—	—	—	2	42x2.5	52x3	2	8	1	36x5	36x5	×	—	3,750.00
—	—	×	—	5	3	1	144	—	—	×	—	2	48	50	2	5	2	36x5	36x4	×	—	3,500.00
×	—	×	—	1	3	1	156	—	—	×	—	2	48x2.5	56x3	4	4	2	36x5	42x5	—	×	3,750.00
×	—	×	—	1	3	1	180	—	—	×	—	2	48x2.5	56x3	4	4	2	36x5	42x5	—	×	3,750.00

IES RANGING FROM 8000 TO 9000 POUNDS.

—	×	×	×	1	3	1	122	—	—	×	—	2	48x3	50x3	2	5	2	36x5	36x4	×	—	3,700.00
—	×	×	—	1	4	1	156	—	—	×	—	2	46x3	52x3	2	5	2	36x5	36x5	×	—	3,650.00
—	—	×	—	1	3	1	...	—	—	×	—	2	42.5x3	49x3	2	3	2	36x5	36x5	—	×	3,750.00

floating. Brakes—1, rear wheels; 2, jackshaft and rear wheels; 3, propellor shaft and rear wheels. Frame—1, wood; 2,
tary transmission; 8, multiple cone. Symbols—×, yes, —, no; =, worm drive, †, concentric gearing; *, oil fed with gasoline;



30 Continental 1-Ton Hoosier Limited 1.5-Ton Coleman Model C

Lambert 2-Ton Kearns 1500-Pound Model A Avery 2-Ton Type B

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Longest, Longest Bros. Co	3A		8000	4	5	5.5	....	40	×	—	—
Mogul, Mogul Motor Truck Co., Inc	0		8000	4	5	5.75	1500	60	×	—	×
Peerless, Peerless Motor Car Co	—		8000	4	4.5	6.5	925	32.4	×	—	×
Randolph, Randolph Motor Truck Co	A		8000	4	4.5	5.5	900	32.4	×	—	—
Schacht, Schacht Motor Car Co	21		8000	4	4.25	5.5	1200	50	×	—	—
Speedwell, Speedwell Motor Car Co	Z		8000	4	5	5	1000	40	×	—	×
Sternberg, Sternberg Mfg. Co	1913		8000	4	4.5	6.75	880	32.4	×	—	×
Vulcan, Driggs Seabury Ordnance Corp	—		8000	4	4.375	5.5	1200	32	×	—	—

GASOLINE SERVICE WAGONS OF CAPACITI

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
A & R, Abendroth & Root Mfg. Co	—		10,000	4	5	5.75	800	40	×	—	—
Alco, American Locomotive Co	4		10,000	4	5	6	1000	36	×	—	—
Brennan, Brennan Motor Mfg. Co	—		10,000	4	5.5	6	800	48.5	×	—	—
Clark, Edward S. Clark	—		10,000	4	4.5	5.5	900	40	×	—	—
De Dion-Bouton, De Dion-Bouton Selling Branch	D. A.		10,000	4	4.25	6	1100	30	×	—	—
Durable Dayton, The Dayton Auto Truck Co	M		10,000	4	5.25	7	....	60	×	—	—
G. M. C., General Motors Truck Co	KD		10,000	4	5	5	800	40	×	—	—
Gramm, Gramm Motor Truck Co	5		10,000	4	5	5	960	40	×	—	×
Harder, Harder Auto Truck Co	A		10,000	4	4.5	6.75	1000	32	×	—	—
KisselKar Truck, Kissel Motor Car Co	—		10,000	4	4.875	5	....	50	×	—	—
Knickerbocker, Knickerbocker Motor Truck Mfg. Co	12-5		10,000	4	4.75	5	1100	36.1	×	—	×
Lauth-Juergens, Lauth-Juergens Motor Car Co	J		10,000	4	4.75	5.5	1000	50	×	—	—
Locomobile, Locomobile Co. of America	A		10,000	4	5	6	900	40	×	—	—
Lord Baltimore, Lord Baltimore Motor Car Co	F		10,000	4	5.25	7	700	44.1	×	—	—
Moeller, New Haven Truck & Auto Works	B		10,000	4	4.25	6.75	800	45	×	—	—
Moreland, Moreland Motor Truck Co	J		10,000	4	5.25	7	....	44.1	×	—	—
Peerless, Peerless Motor Car Co	—		10,000	4	4.5	6.5	925	32.4	×	—	×
Pierce-Arrow, Pierce-Arrow Motor Car Co	—		10,000	4	4.875	6	950	38	×	—	..
Pierce-Arrow, Pierce-Arrow Motor Car Co	—		10,000	4	4.875	6	950	38	×	—	..
Pope-Hartford, The Pope Mfg. Co	—		10,000	4	....	....	....	50	×	—	—
Rowe, Rowe Motor Mfg. Co	F		10,000	4	5.25	7	....	60	×	—	—
Saurer, International Motor Co		I	10,000	4	4.375	5.5	1000	28	×	—	—
Stearns, F. B. Stearns Co	—		10,000	4	4.75	6	1200	36.1	×	—	×
Stearns, F. B. Stearns Co	—		10,000	4	4.75	6	1200	36.1	×	—	×
Sternberg, Sternberg Mfg. Co	1913		10,000	4	4.5	6.75	898	32.4	×	—	×
Transit, Transit Motor Truck Co	V		10,000	4	4.75	5.5	1300	36.15	×	—	—
Victor, Victor Motor Truck Co	—		10,000	4	4.875	5.5	1000	50	×	—	—
Vulcan, Driggs Seabury Ordnance Corp	—		10,000	4	4.375	5.5	1200	32	×	—	—
Walter, Walter Motor Truck Co	—		10,000	4	4.5	6	....	32.1	×	—	—
Walter, Walter Motor Truck Co	—		10,000	4	4.5	6	....	32.1	×	—	—
White, The White Co	TC		10,000	4	4.25	5.75	....	40	×	—	—
White, The White Co	TKA		10,000	4	4.25	5.75	....	40	×	—	—

GASOLINE SERVICE WAGONS OF CAPACITI

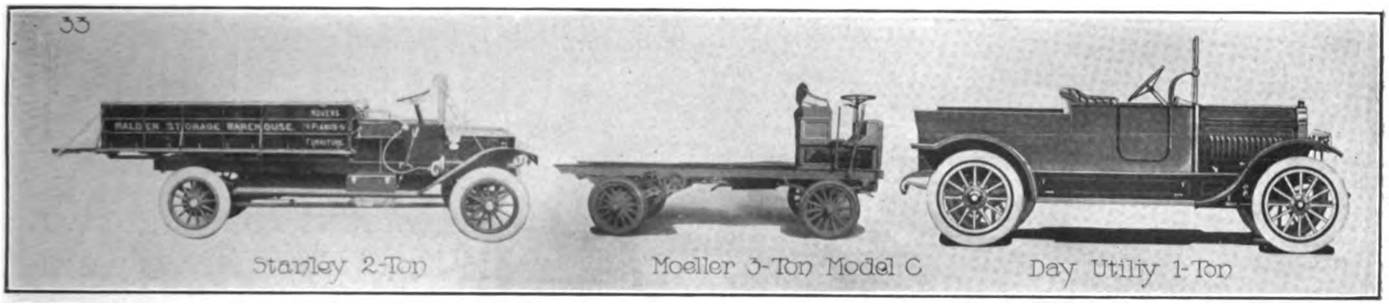
Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Garford, The Garford Co	78		12,000	4	4.625	6	1500	34.2	×	—	—
La France, American-La France Fire Engine Co	—		12,000	4	5.5	6	1200	48	×	—	—
Mogul, Mogul Motor Truck Co., Inc	M		12,000	4	5.25	5.75	1500	60	×	—	×
Mogul, Mogul Motor Truck Co., Inc	U		12,000	4	5.25	5.75	1500	60	×	—	×
Randoph, Randolph Motor Truck Co	A		12,000	4	5	5.75	900	40	×	—	—
Smith-Milwaukee, A. O. Smith Co	C		12,000	4	5.25	5.75	900	44	×	—	×

GASOLINE SERVICE WAGONS OF CAPACITI

Make Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P., S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Aries, Automobile Aries	—		14,000	4	5	5.75	1000	40	×	—	—
Aries, Automobile Aries	—		14,000	4	5	6.25	1000	40	×	—	—
Vulcan, Driggs Seabury Ordnance Corp	—		14,000	4	4.75	5.5	1000	36	×	—	—
Vulcan, Driggs Seabury Ordnance Corp	—		14,000	4	4.75	5.5	1000	36	×	—	—

Axles—1, tubular; 2, I section; 3, rectangular; 4, solid forging; 5, dead; 6, semi-floating; 7, three-quarter floating; 8, full steel; 3, armored wood. Clutch—1. cone; 2, contracting band; 3, expanding band; 4, multiple disc; 5, disc; 6, friction; 7, plane- ‡, double grooved roller friction drive; **, gravity; ¶, steel.

Brockway Model C Auglaize 1-Ton Juno 2-Ton Model E



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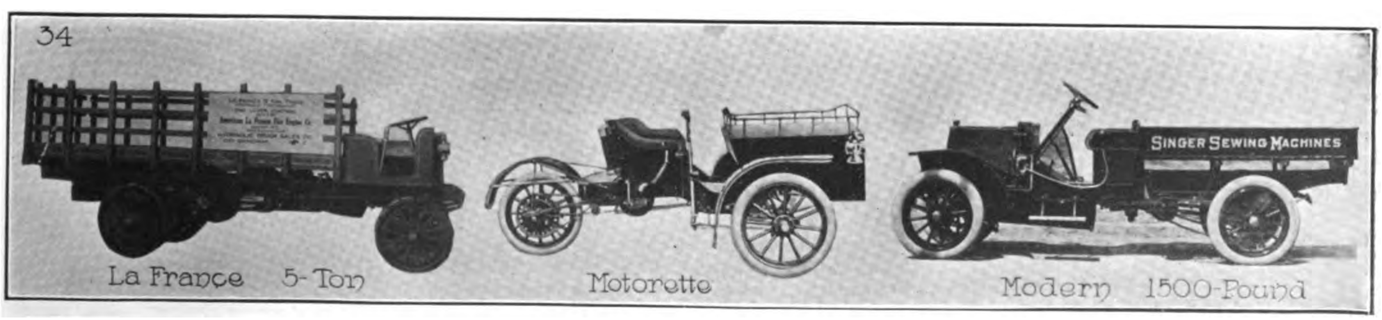
Stanley 2-Ton Moeller 3-Ton Model C Day Utiliy 1-Ton

Lubrication, Force Feed	Lubrication, Combination	Ignition Magneto	Ignition, Battery	Clutch	Speed Ratio Forward	Speed Ratio, Reverse	Wheelbase, Inches	Drive, Shaft	Drive, Chain	Drive, Double Chain	Friction Drive	Frame Material	Springs Front	Rear	Axles, Front	Axles, Rear	Brakes	Tires, Front	Tires, Rear	Drive, Right	Drive, Left	Price
×	—	×	—	1	4	1	...	—	—	×	—	2	45x3	45x3	4	4	2	36x5	36x5	×	—	4,000.00
—	—	×	—	5	3	1	142	—	—	×	—	2	50x4	56x4	4	4	1	36x6	40x5	×	—	3,800.00
—	—	×	—	3	4	1	174	—	—	×	—	2	......	......	..	4	2	36x5	40x5	×	—	4,000.00
×	—	×	—	1	3	1	136	—	—	×	—	2	50x4	55x4	2	3	1	36x6	40x5	..	..	......
×	—	×	—	1	3	1	144	—	—	×	—	2	40x2.5	50x3	2	5	2	36x4	36x5	—	×	3,300.00
—	—	×	—	1	3	1	115	—	—	×	—	2	40x3	48x3	2	5	2	36x5	36x5	—	×	3,750.00
—	—	×	—	4	3	1	144	—	—	×	—	3	51x3	54x3.5	2	4	2	36x5	40x5	×	—	4,000.00
—	×	×	—	1	3	1	150	—	—	×	—	2	48x2.5	55x3	4	4	2	36x5	36x5	..	..	4,000.00
ES RANGING FROM 10,000 TO 12,000 POUNDS.																						
—	×	×	×	1	3	1	130	—	—	×	—	2	48x3	50x3	2	5	2	36x6	36x5	×	—	4,350.00
—	×	×	—	4	3	1	143	—	—	×	—	2	47x3	54x3	4	4	3	36x6	42x5	..	..	4,750.00
×	—	×	—	1	3	1	136	—	—	×	—	2	45x3	50x3	2	3	2	36x5	38x5	×	—	4,800.00
—	×	×	—	1	3	1	144	—	—	×	—	2	44x3	52x3	2	3	2	36x6	42x5	—	×	4,200.00
×	—	×	—	4	3	1	156	×	—	—	—	3	50x4	60x4	2	..	3	36x5	38x5	—	×	......
×	—	×	×	4	3	1	150	×	—	—	—	2	......	......	2	3	2	36x6	42x5	—	×	4,500.00
—	×	×	—	4	3	1	138	—	—	×	—	2	46x3	56x3	2	5	2	36x6	36x5	×	—	4,400.00
—	—	×	—	4	4	1	130	—	—	×	—	2	46.5x3.5	46.5x3.5	3	5	2	36x5	31x5	×	—	4,500.00
×	—	×	—	8	3	1	144	—	—	×	—	2	......	......	4	4	2	36x6	36x5	×	—	4,400.00
—	×	×	—	1	4	1	156	—	—	×	—	2	46x3	54x3	2	5	2	36x5	40x6	×	—	4,350.00
—	—	×	—	1	3	1	...	—	—	×	—	2	42.5x3	49x3	2	3	2	36x6	36x6	—	×	4,500.00
—	×	×	—	4	4	1	140	—	—	×	—	2	44x3	54x3.5	2	3	2	40x6	40x6	×	—	4,500.00
—	×	×	—	5	4	1	140	—	—	×	—	2	42x3	50x3	2	3	2	40x6	40x6	×	—	4,800.00
×	—	×	—	1	3	1	140	—	—	×	—	2	40x3	60x3	3	5	2	36x6	42x6	×	—	4,250.00
×	—	×	—	4	3	1	138	—	—	×	—	2	47x3	52x3	4	5	1	36x5	36x5	×	—	4,500.00
×	—	×	—	2	4	1	156	—	—	×	—	2	46x3.5	50x3.5	2	5	2	36x6	40x5	×	—	......
—	—	×	—	3	4	1	174	—	—	×	—	2	......	......	..	4	2	38x6	42x6	×	—	4,500.00
*	*	×	×	1	3	1	168	=	—	—	—	2	36x2.5	48x3	2	8	3	36x5	40x6	×	—	4,500.00
*	*	×	×	1	3	1	204	=	—	—	—	2	36x2.5	48x3	2	8	3	36x5	40x6	×	—	4,500.00
×	—	×	—	1	4	1	140	—	—	×	—	2	45	52	2	4	2	36x7	42x6	—	×	4,350.00
×	—	×	—	4	3	1	156	—	—	×	—	2	40x3	50x3	2	3	1	36x5	36x5	×	—	4,800.00
—	×	×	—	1	4	1	155	—	—	×	—	2	39.37x2.37	55x2.37	3	3	2	36x5	42x5	×	—	5,000.00
—	—	×	—	5	4	1	144	—	—	×	—	2	46x3	56x3.5	2	2	2	34x5	38x5	—	×	3,800.00
—	—	×	—	5	4	1	180	—	—	×	—	2	46x3	56x3.5	2	2	2	34x5	38x5	—	×	3,900.00
—	—	×	—	4	3	1	144	—	—	×	—	3	51x3	54x3.5	2	4	2	36x6	42x6	×	—	4,500.00
×	—	×	—	5	3	1	144	—	—	×	—	2	48x3.5	50x3.5	2	5	2	36x6	40x6	×	—	4,500.00
—	×	×	—	1	3	1	156	—	—	×	—	2	45x2.5	52x3.5	2	3	2	36x5	40x6	..	..	3,650.00
—	×	×	—	1	3	1	150	—	—	×	—	2	48x2.5	55x3	4	4	2	36x6	36x6	×	—	4,750.00
×	—	×	—	1	3	1	156	—	—	×	—	2	48x2.5	56x3	4	4	2	38x6	42x6	—	×	4,500.00
×	—	×	—	1	3	1	180	—	—	×	—	2	48x2.5	56x3	4	4	2	38x6	42x6	—	×	4,500.00
—	×	×	—	1	4	1	165	—	—	×	—	2	......	......	3	5	2	36x5	40x6	—	×	4,500.00
—	×	×	—	1	4	1	145	—	—	×	—	2	......	......	3	5	2	36x5	40x6	—	×	4,700.00
ES RANGING FROM 12,000 TO 14,000 POUNDS.																						
—	×	×	—	1	3	1	136	—	—	×	—	2	......	......	4	5	1	36x6	40x6	×	—	......
—	×	×	—	..	..	..	163	—	—	×	—	2	42x3.5	48x3.5	2	3	1	36x5	38x6	×	—	5,500.00
—	—	×	—	5	3	1	154	—	—	×	—	2	50x4	56x4	3	4	1	36x6	40x5	×	—	4,400.00
—	—	×	—	5	3	1	188	—	—	×	—	2	50x4	56x4	3	4	1	36x6	40x6	×	—	4,700 00
×	—	×	—	1	4	1	140	—	—	×	—	2	50x4	55x4	2	3	1	36x7	40x6	..	..	4,500.00
—	—	×	—	4	3	1	168	=	—	—	—	2	46x3	54x3.5	2	8	1	36x6	40x6	×	—	4,750.00
ES RANGING FROM 14,000 POUNDS UPWARD.																						
—	×	×	—	5	3	1	156	—	—	×	—	2	48x2.75	54x3.12	4	4	3	5.5x1.75¶	8x1.75¶	×	—	6,000.00
×	—	×	—	5	3	1	156	—	—	×	—	2	48x2.75	54x3.12	4	4	3	5.5x1.75¶	8x1.75¶	×	—	6,000.00
—	×	×	—	1	4	1	156	—	—	×	—	2	48x3	55x3.5	4	4	2	36x7	42x7	..	..	5,600.00
—	×	×	—	1	4	1	168	—	—	×	—	2	48x3	55x3.5	4	4	2	36x7	42x7	..	..	5,600.00

floating. Brakes—1, rear wheels; 2, jackshaft and rear wheels; 3, propellor shaft and rear wheels. Frame—1, wood; 2,
tary transmission; 8, multiple cone. Symbols—×, yes; —, no; =, worm drive; †, concentric gearing; *, oil fed with gasoline;



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La France 5-Ton Motorette Modern 1500-Pound

Make	Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P.: S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Hewitt	International Motor Co		II	20,000	4	4.25	6	1000	28.9	×	—	—
Hewitt	International Motor Co	—		20,000	4	4.25	6	1000	28.9	×	—	—

GASOLINE WAGONS FOR MUNICIPAL S

Make	Maker	Model	Type	Capacity, Pounds	No. Cylinders	Bore	Stroke	R. P. M.	H. P.: S. A. E. Rating	Water Cooling	Air Cooling	Lubrication, Splash
Stanley Steamer	Stanley Motor Carriage Co	810		....	2	4.5	6.5	....	30	..	..	—
Seagrave	The Seagrave Co	C		....	4	5.75	6	1000	52.8	×	—	—
Seagrave	The Seagrave Co	D		....	6	5.75	6	1000	80	×	—	—
Seagrave	The Seagrave Co	R		....	6	7.75	9	750	144	×	—	—
Crow Elkhart	Crow Motor Car Co	CT		....	4	4	4.5	2400	33	×	—	×

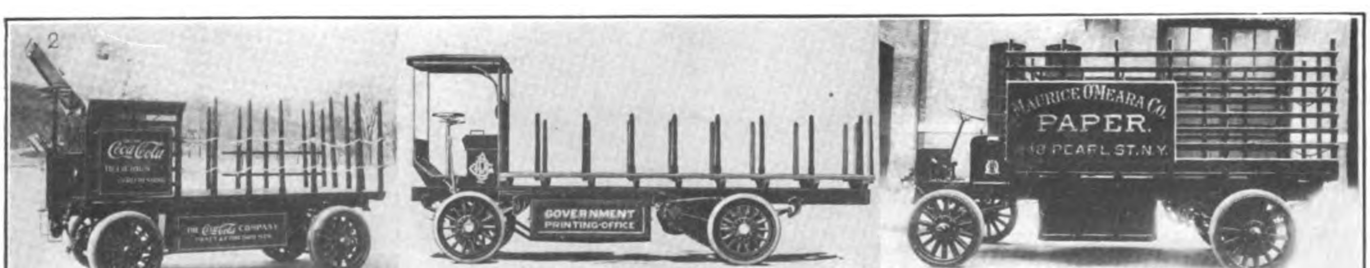
Axles—1, tubular; 2, I section; 3, rectangular; 4, solid forging; 5, dead; 6, semi-floating; 7, three-quarter floating; 8, full steel; 3, armored wood. Clutch—1, cone; 2, contracting band; 3, expanding band; 4, multiple disc; 5, disc; 6, friction; 7, plane- ‡, double grooved roller friction drive; **, gravity; ¶, steel.

Standard Specifications of Electric Service Wag

1 Ohio 1-Ton Fritchle G.M.C. 3-Ton

Make	Manufacturer	Model	Type	Capacity	Motor: G. E.	Motor: West.	Motor: Own	Motor R. P. M	Wheelbase	Weight	Battery and No. Cells: Edison	Battery and No. Cells: Lead	Battery and No. Cells: Own	Loading Space	Approx. Mileage
Argo Electric	Argo Electric Vehicle Co	K-10	..	1,000	—	×	—	....	86	2,800	—	40	—	90x42	50
Argo Electric	Argo Electric Vehicle Co	K-20	..	2,000	—	×	—	....	96	3,400	—	40	—	100x42	50
Atlantic	Atlantic Vehicle Co	1	A	2,000	×	—	—	....	102	4,400	—	44	—	96x60	55-60
Atlantic	Atlantic Vehicle Co	2	A	4,000	×	—	—	....	114	5,700	—	44	—	126x60	50
Atlantic	Atlantic Vehicle Co	3	A	7,000	×	—	—	....	135	7,700	—	44	—	144x72	..
Atlantic	Atlantic Vehicle Co	5	A	10,000	×	—	—	....	144	9,200	—	44	—	144x72	..
Bailey	S. R. Bailey & Co., Inc	Service	..	300	×	—	—	1800	106	2,350	60	—	—	38x24	100
Baker	Baker Motor Vehicle Co	W	..	500	×	—	—	....	80	2,085	—	30	—	......	75
Baker	Baker Motor Vehicle Co	X	..	1,000	×	—	—	1800	85	2,650	..	*	..	90	50
Baker	Baker Motor Vehicle Co	O	..	2,000	×	—	—	1200	102	3,125	..	*	..	118	50
Baker	Baker Motor Vehicle Co	U	..	4,000	×	—	—	1200	120	5,200	..	*	..	142	50
Baker	Baker Motor Vehicle Co	CC	..	7,000	×	—	—	1200	134	7,500	..	*	..	170	50
Couple-Gear	Couple-Gear Freight-W. Co...	H-Dble Ender	..	7,000	—	—	×	....	96	....	—	42	—	171x66	..
Couple-Gear	Couple-Gear Freight-Wheel Co	HE	..	7,000	—	—	×	....	96	8,500	—	×	—	168x54	40
Couple-Gear	Couple-Gear Freight-Wheel Co	AF	..	10,000	—	—	×	....	90	11,000	—	×	—	......	30
Couple-Gear	Couple-Gear Freight-Wheel Co	A	..	10,000	—	—	×	....	96	10,000	—	×	—	180x78	35
Couple-Gear	Couple-Gear Freight-Wheel Co	ACB	..	12,000	..	..	..	....	144	....	..	..	..	......	..
Couple-Gear	Couple-Gear Freight-Wheel Co	HF	..	14,000	—	—	×	....	90	9,000	—	×	—	‡‡	40
Couple-Gear	Couple-Gear Freight-Wheel Co	ACT	..	24,000	..	..	..	....	180	....	..	..	..	......	..
C T	Commercial Truck Co. of America	..	..	500	×	—	—	1600	85	3,000	..	*	..	66x42	..
C T	Commercial Truck Co. of America	..	..	1,000	×	—	—	1200	100	3,500	..	*	..	72x42	..
C T	Commercial Truck Co. of America	..	..	2,000	×	—	—	1500	100	4,500	..	*	..	96x48	..
C T	Commercial Truck Co. of America	..	..	4,000	×	—	—	1200	116	6,500	..	*	..	132x50	..
C T	Commercial Truck Co. of America	..	..	7,000	×	—	—	1500	115	9,000	..	*	..	144x60	..
C T	Commercial Truck Co. of America	..	..	10,000	×	—	—	1500	132	10,500	..	*	..	180x66	..
Detroit Electric	Anderson Electric Car Co	1	..	1,000	—	—	×	1300	80	2,400	60	—	—	78x45	50
Detroit Electric	Anderson Electric Car Co	2	..	2,000	—	—	×	....	84	3,100	60	—	—	82x47	55

Motor—G. E., general electric; West, Westinghouse. Control—S, driver's seat; W, wheel; C, centre. Speed ratio—F, for- shaft. Symbols—×, yes; —, no; *, optional; †, gas electric power plant; **, Bailey pivot; §, Diehl motor; ‡, steel tires; ‡‡, used round. Method of drive—1, shaft and bevel gear; 2, shaft and side chains; 3, shaft, chain and herringbone gear; 4, shaft and tors in wheels



2 C.T. 3.5-5-Ton Baker 4-Ton Atlantic 3.5-Ton

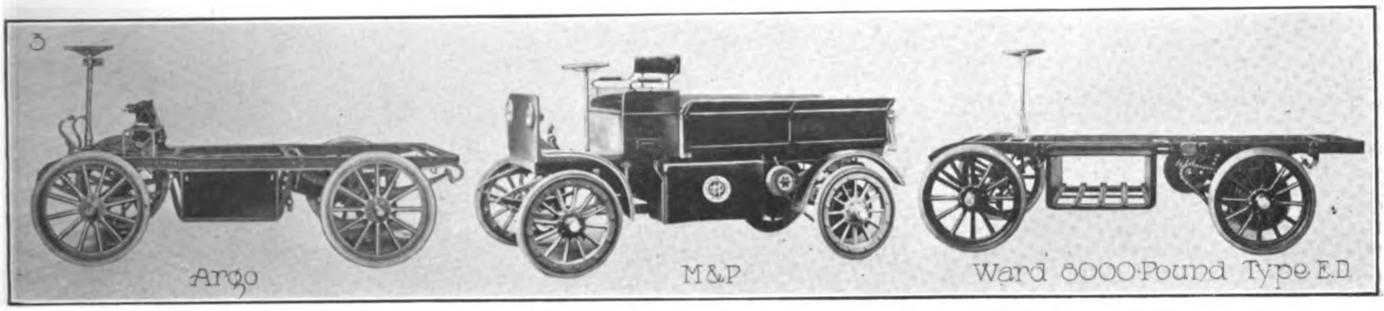
Lubrication, Force Feed	Lubrication, Combination	Ignition Magneto	Ignition, Battery	Clutch	Speed Ratio Forward	Speed Ratio, Reverse	Wheelbase, Inches	Drive, Shaft	Drive, Chain	Drive, Double Chain	Friction Drive.	Frame Material	Springs Front	Rear	Axles, Front	Axles, Rear	Brakes	Tires, Front	Tires, Rear	Drive, Right	Drive, Left	Price
×	—	×	—	..	2	1	138	—	—	×	—	2	48x3.5	54x3.5	3	3	3	36x5	36x7	—	×	5,500.00
×	—	×	—	..	2	1	164	—	—	×	—	2	48x3.5	54x3.5	3	3	3	36x5	36x7	—	×	5,500.00

ERVICE UNCLASSIFIED AS TO WEIGHT.

×	—	..	..	..	1	1	136	..	..	..	..	1	36x2	36x2	1	1	1	36x5	36x5	×	—	2,300.00
×	—	×	—	1	3	1	140	—	—	×	—	2	......	......	4	5	2	36x4	38x3.5	..	..	5,000.00
×	—	×	—	1	3	1	144	—	—	×	—	2	......	......	4	5	2	36x4	38x3.5	..	..	5,500.00
×	—	×	—	1	4	1	160	—	—	×	—	2	*.....	......	4	3	2	40x4	40x4	..	..	10,500.00
—	—	×	—	4	3	1	114	×	—	—	—	2	36x2	38x2	2	7	1	34x3.5	34x3.5	×	—	......

floating. Brakes—1. rear wheels; 2. jackshaft and rear wheels; 3. propellor shaft and rear wheels. Frame—1. wood; 2, tary transmission; 8. multiple cone. Symbols—×, yes; —, no; =, worm drive; †, concentric gearing; *, oil fed with gasoline;

ons of American Make Produced for 1913.



Argo M&P Ward 8000-Pound Type E.D

Springs Front	Springs Rear	Speed M. P. H.	Speed Ratio: Front	Speed Ratio: Rear	Axles: Front	Axles: Rear	Drive Side: R.	Drive Side: L.	Control: S.	Control: W.	Control: C.	Drive Method	Brakes: R. W.	Brakes: R. W. J. S.	Brakes: R. W. M. S.	Brakes: All Wheels	Frame: Wood	Frame: Steel	Tires: Front	Tires: Rear	Battery Location: Under Chassis	Battery Location: On Chassis	Battery Location: Under Seat	Bearings: Roller	Bearings: Ball	Bearings: Comb.	Price
40x2	48x2	12	4	3	1	4	—	×	—	×	—	4	×	—	—	—	—	×	34x3	34x3	×	—	—	—	×	—	$1,700
40x2	48x2	12	4	3	1	4	—	×	—	×	—	4	×	—	—	—	—	×	34x3.5	34x3.5	×	—	—	—	×	—	2,100
40x2.5	48x2.5	12	4	2	2	3	—	×	×	—	—	5	—	×	—	—	—	×	34x3.5	36x4	×	—	—	—	—	×	2,400
40x2.5	48x2.5	10	4	2	2	3	—	×	×	—	—	5	—	×	—	—	—	×	36x3	34x4	×	—	—	—	—	×	3,000
44x3	56x3	10	4	2	2	3	—	×	×	—	—	5	—	×	—	—	—	×	36x5	40x4	×	—	—	—	—	×	3,500
44x3	56x3	9	4	2	2	3	—	×	×	—	—	5	—	×	—	—	—	×	36x5	40x5	×	—	—	—	—	×	4,000
46	38	25	6	3	6	2	—	×	—	×	—	5	—	×	—	—	×	×	33x4	33x4	×	—	×	..	**	..	....
....	....	20	6	3	1	3	—	×	—	×	—	1	—	×	—	—	—	×	32x3.5	32x3.5	×	—	—	×	—	—	1,700
40x2	40x2	14.5	5	3	2	3	—	×	—	×	—	5	—	×	—	—	—	×	34x3	34x3	×	—	—	—	—	×	1,900
40x2.5	44x2.5	12.5	5	3	2	3	—	×	—	×	—	5	—	×	—	—	—	×	36x3.5	36x3.5	×	—	—	—	—	×	2,300
44x3	44x3	10	5	3	2	3	—	×	—	×	—	5	—	×	—	—	—	×	36x6	36x3	×	—	—	—	—	×	3,100
44x3.5	44x3.5	9	5	3	2	3	—	×	—	×	—	5	—	×	—	—	—	×	36x6	36x3.5	×	—	—	×	—	—	3,500
44x3	44x3	8.5	5	5	7	7	×	—	—	—	×	9	—	—	—	×	—	×	36x3.5	36x3.5	×	—	—	×	—	—	4,400
44x3	44x3	15	5	5	7	7	×	—	—	—	×	9	—	—	—	×	—	×	36x3.5	36x3.5	×	—	—	×	—	—	....
44x3	44x3	6	5	5	7	3	×	—	—	—	×	9	—	—	—	×	—	×	30x5	‡48x6	—	—	×	×	—	—	....
44x3	44x3	7	5	5	7	7	×	—	—	—	×	9	—	—	—	×	—	×	36x4	36x4	×	—	—	×	—	—	5,000
44x3	44x3	..	..	..	7	7	×	—	..	..	..	†	—	—	—	×	—	×	36x5	36x5	..	..	..	×	—	—	....
44x3	42x3	20	15	15	7	7	×	—	—	—	×	9	—	—	—	×	—	×	36x4	36x4	×	—	—	×	—	—	....
44x3	42x3	..	..	..	7	7	×	—	..	..	..	†	—	—	—	×	—	×	36x5	36x5	..	..	..	×	—	—	....
....	42x1.7	15	3	2	6	4	—	×	—	×	—	6	×	—	—	—	—	×	36x2.5	36x2.5	×	—	—	×	—	—	1,800
....	42x1.7	15	3	2	6	4	—	×	—	×	—	6	×	—	—	—	—	×	36x2.5	36x3	×	—	—	×	—	—	2,000
46x2	48x2.5	12	4	2	6	6	—	×	—	×	—	7	×	—	—	—	—	×	36x3.5	36x4	×	—	—	×	—	—	2,600
48x2.5	48x3	10	4	2	6	6	—	×	—	×	—	7	×	—	—	—	—	×	36x5	36x3.5	×	—	—	×	—	—	3,200
48x3	48x3	9	4	2	6	6	—	×	—	×	—	8	×	—	—	—	—	×	36x3.5	36x3.5	×	—	—	×	—	—	4,200
48x3	48x3	7	4	2	6	6	—	×	—	×	—	8	×	—	—	—	—	×	36x4	36x4	×	—	—	×	—	—	4,650
40x1.7	40x1.7	14	5	5	2	3	—	×	—	×	—	5	—	×	—	—	—	×	32x2.5	34x3	×	—	—	×	—	—	2,345
40x2	40x2	12	5	5	2	3	—	×	—	×	—	5	—	×	—	—	—	×	32x3	34x3.5	×	—	—	×	—	—	2,870

ward; R. reverse. Brakes—R. W. rear wheel; R. W. J. S., rear wheel and countershaft; R. W. M. S., rear wheel and motor as tractor. Axles—1. tubular. 2. I section. 3, rectangular. 4. full floating; 5, semi-floating. 6. special; 7. frame construction. 8, herringbone gear. 5. double chain reduction. 6, shaft and worm gearing; 7, concentric gearing; 8, spur gears enclosed; 9, mo-

Urban 3.5-Ton Model 70 Detroit 3.5-Ton Model 7 Waverley 3.5-Ton

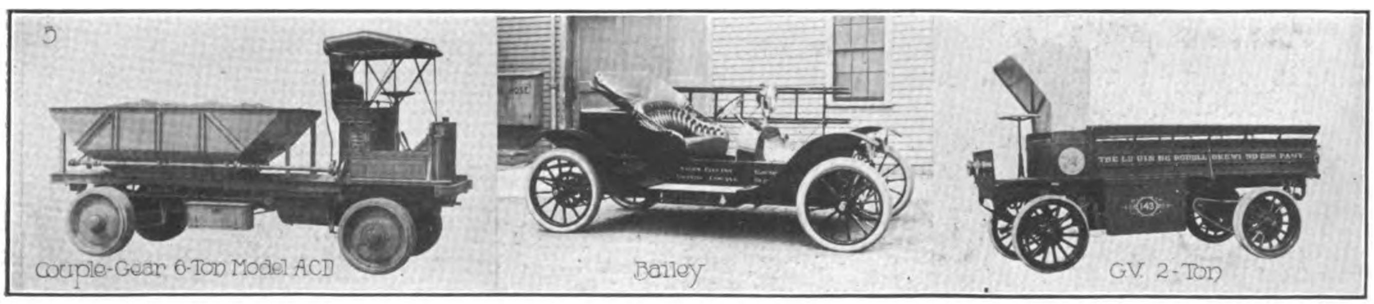
Make Manufacturer	Model	Type	Capacity	Motor G. E.	Motor West.	Motor Own	Motor R. P. M	Wheelbase	Weight	Battery and No. Cells Edison	Battery and No. Cells Lead	Battery and No. Cells Own	Loading Space	Approx. Mileage
Detroit Electric, Anderson Electric Car Co..........	3	..	3,000	—	—	×	1120	96	4,650	60	—	—	......	55
Detroit Electric, Anderson Electric Car Co..........	7	..	7,000	—	—	×	1200	132	8,115	60	—	—	156	40
Fritchle, Fritchle Automobile & Battery Co....... ..	..	.. ..	1,000	—	—	×	....	100	....	—	—	32	..	..
G-M-C Electric, General Motors Truck Co..........	1	A	1,000	×	—	—	....	94	....	60 or 44	—		88	..
G-M-C Electric, General Motors Truck Co..........	1	B	1,000	×	—	—	....	106	....	60 or 44	—		106	..
G-M-C Electric, General Motors Truck Co..........	1	C	1,000	×	—	—	....	124	....	60 or 44	—		130	..
G-M-C Electric, General Motors Truck Co..........	2	A	2,000	×	—	—	....	104	....	60 or 44	—		100	..
G-M-C Electric, General Motors Truck Co..........	2	B	2,000	×	—	—	....	118	....	60 or 44	—		118	..
G-M-C Electric, General Motors Truck Co..........	2	C	2,000	×	—	—	....	136	....	60 or 44	—		142	..
G-M-C Electric, General Motors Truck Co..........	3	A	3,000	×	—	—	....	112	....	60 or 44	—		112	..
G-M-C Electric, General Motors Truck Co..........	3	B	3,000	×	—	—	....	130	....	60 or 44	—		136	..
G-M-C Electric, General Motors Truck Co..........	3	C	3,000	×	—	—	....	148	....	60 or 44	—		160	..
G-M-C Electric, General Motors Truck Co..........	4	A	4,000	×	—	—	....	120	....	60 or 44	—		124	..
G-M-C Electric, General Motors Truck Co..........	4	B	4,000	×	—	—	....	138	....	60 or 44	—		148	..
G-M-C Electric, General Motors Truck Co..........	4	C	4,000	×	—	—	....	156	....	60 or 44	—		172	..
G-M-C Electric, General Motors Truck Co..........	6	A	6,000	×	—	—	....	132	....	60 or 44	—		136	..
G-M-C Electric, General Motors Truck Co..........	6	B	6,000	×	—	—	....	150	....	60 or 44	—		160	..
G-M-C Electric, General Motors Truck Co..........	6	C	6,000	×	—	—	....	168	....	60 or 44	—		184	..
G-M-C Electric, General Motors Truck Co..........	8	A	8,000	×	—	—	....	138	....	60 or 44	—		148	..
G-M-C Electric, General Motors Truck Co..........	8	B	8,000	×	—	—	....	156	....	60 or 44	—		172	..
G-M-C Electric, General Motors Truck Co..........	8	C	8,000	×	—	—	....	174	....	60 or 44	—		196	..
G-M-C Electric, General Motors Truck Co..........	10	A	10,000	×	—	—	....	148	....	60 or 44	—		160	..
G-M-C Electric, General Motors Truck Co..........	10	B	10,000	×	—	—	....	166	....	60 or 44	—		184	..
G-M-C Electric, General Motors Truck Co..........	10	C	10,000	×	—	—	....	184	....	60 or 44	—		208	..
G-M-C Electric, General Motors Truck Co..........	12	A	12,000	×	—	—	....	156	....	60 or 44	—		172	..
G-M-C Electric, General Motors Truck Co..........	12	B	12,000	×	—	—	....	174	....	60 or 44	—		196	..
G-M-C Electric, General Motors Truck Co..........	12	C	12,000	×	—	—	....	192	....	60 or 44	—		220	..
G V, The General Vehicle Co., Inc..................	..	..	750	×	—	—	1600	76	2,830	—	—	×	58x40	45
G V, The General Vehicle Co., Inc..................	..	..	1,000	×	—	—	2000	86	3,620	—	—	×	72x41	45
G V, The General Vehicle Co., Inc..................	..	..	2,000	×	—	—	1200	102	4,100	—	—	×	96x48	45
G V, The General Vehicle Co., Inc..................	..	..	4,000	×	—	—	1200	111	6,480	—	—	×	137x56	45
G V, The General Vehicle Co., Inc..................	..	..	7,000	×	—	—	1200	128	9,500	—	—	×	156x60	40
G V, The General Vehicle Co., Inc..................	..	..	10,000	×	—	—	1200	139	10,500	—	—	×	180x62	35
Jatco, Joliet Auto Tire Company..................	D-3	..	1,000	..	§	..	1200	86	2,800	60	—	—	100x48	50-60
Lansden, The Lansden Company....................	M	..	1,000	×	—	—	1200	96	2,750	60	—	—	91x46	60
Lansden, The Lansden Company....................	M	..	2,000	×	—	—	1000	106	4,400	60	—	—	114x46	60
Lansden, The Lansden Company....................	M	..	4,000	×	—	—	1100	120	6,000	60	—	—	121x50	50
Lansden, The Lansden Company....................	M	..	7,000	×	—	—	1100	130	8,000	60	—	—	144x54	50
Lansden, The Lansden Company....................	M	..	10,000	×	—	—	1000	142	10,000	60	—	—	162x58	50
M & P, M & P Electric Vehicle Co..................	..	..	1,500	—	×	—	1500	100	3,200	—	40	—	80x45	40-45
M & P, M & P Electric Vehicle Co..................	..	..	2,000	—	×	—	1500	112	3,900	—	40	—	92x45	45
Urban, Kentucky Wagon Mfg. Co..................	10	..	1,000	×	—	—	2000	86	3,400	—	30	—	72x42	45-50
Urban, Kentucky Wagon Mfg. Co..................	20	..	2,000	×	—	—	1200	102	5,660	—	44	—	96x48	40-45
Urban, Kentucky Wagon Mfg. Co..................	40	..	4,000	×	—	—	1200	118	7,882	—	44	—	132x68	40-45
Urban, Kentucky Wagon Mfg. Co..................	70	..	7,000	×	—	—	1200	130	9,780	—	44	—	148x80	40-45
Walker, Walker Vehicle Co......................	F	..	1,000	—	×	—	....	80	....	..	*	..	*	..
Walker, Walker Vehicle Co......................	G	..	1,000	—	×	—	....	115	....	..	*	..	*	..
Walker, Walker Vehicle Co......................	C	..	1,500	—	×	—	....	93	....	..	*	..	*	..
Walker, Walker Vehicle Co......................	B	..	3,500	—	×	—	....	100	....	..	*	..	*	..
Walker, Walker Vehicle Co......................	D	..	5,000	—	×	—	....	130	....	..	*	..	*	..
Walker, Walker Vehicle Co......................	E	..	7,000	—	×	—	....	130	....	..	*	..	*	..
Ward, Ward Motor Vehicle Co....................	EA	..	1,000	—	—	×	....	84	2,500	..	*	..	78x37	45-60
Ward, Ward Motor Vehicle Co....................	EB	..	2,000	—	—	×	....	96	4,800	..	*	..	96x38	40-50
Ward, Ward Motor Vehicle Co....................	EC	..	4,000	—	—	×	....	114	5,500	..	*	..	117x38	35-45
Ward, Ward Motor Vehicle Co....................	ED	..	8,000	—	—	×	....	132	8,000	..	*	..	144x38	30-35
Waverley, The Waverley Co......................	..	..	1,000	—	—	×	....	91	3,125	..	*	..	72x40	50
Waverley, The Waverley Co......................	..	..	2,000	—	—	×	....	108	3,400	..	*	..	......	50
Waverley, The Waverley Co......................	..	..	4,000	..	*	..	....	114	6,300	..	*	..	132x54	45
Waverley, The Waverley Co......................	..	..	7,000	..	*	..	....	127	7,250	..	*	..	144x60	40
Waverley, The Waverley Co......................	..	..	10,000	..	*	..	....	136	9,700	..	*	..	168x78	35

Motor—G. E., general electric; West. Westinghouse. Control—S, driver's seat; W. wheel; C, centre. Speed ratio—F, for- shaft. Symbols—×, yes; —, no; *, optional; † gas electric power plant; **, Bailey pivot; §, Diehl motor; ‡, steel tires; ‡‡, used round. Method of drive—1, shaft and bevel gear; 2, shaft and side chains; 3, shaft, chain and herringbone gear; 4, shaft and tors in wheels.

SPECIFICATION ILLUSTRATIONS

GASOLINE VEHICLES.

Name of Vehicle	Page
A. & R.	VII
Adams, One Ton	VI
Alco, 6.5 Tons	VIII
Aries, Seven Tons	7
Atterbury, Model D	4
Auglaize, One Ton	10
Autocar	2
Available, Model 24	1
Avery, Type B, Two Tons	10
Babcock, Model G	5
Bergdoll Delivery	VIII
Bessemer, One Ton	VIII
Blair, 2.5 Tons	2
Brennan, Five Tons	7
Brockway, Model C	10
Brooks	8
Cameron	6
Coleman, Model G	9
Commerce, Model A	9
Commercial, One Ton	9
Crawford, 13-30	VIII
Croce, Model A	2
Crow, Model CD	9
Crown, Model G	5
Day Utility	11
De Dion-Bouton, Five Tons	8
Durable Dayton	VI
Federal	1
Four Wheel Drive, Three Ton	VIII
Franklin	5
Garford, Model D	3
G. M. C., Model H	3
B. A. Gramm's Truck, 3.5 Tons	6



Couple-Gear 6-Ton Model ACD — Bailey — GV. 2-Ton

Springs Front	Springs Rear	Speed M. P. H.	Speed Ratio Front	Speed Ratio Rear	Axles Front	Axles Rear	Drive Side R.	Drive Side L.	Control S.	Control W.	Control C.	Drive Method	Brakes R. W.	Brakes R. W. J. S.	Brakes R. W. M. S.	Brakes All Wheels	Frame Wood	Frame Steel	Tires Front	Tires Rear	Battery Location Under Chassis	Battery Location On Chassis	Battery Location Under Seat	Bearings Roller	Bearings Ball	Bearings Comb.	Price
....	....	11	5	5	2	3	—	×	—	×	—	5	—	×	—	—	—	×	34x3.5	36x4	×	—	—	×	—	—	3,100
48x3	48x3	8	5	5	2	3	—	×	—	×	—	5	—	×	—	—	—	×	36x6	36x4	×	—	—	×	—	—	5,000
....	....	..	6	3	..	..	—	×	×	—	—	5	×	—	—	—	×	—	32x3.5	32x3.5	..	..	..	—	×	—	2,000
....	....	13	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x2.5	32x3.5	—	—	×	—	×	—	1,385
....	....	13	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x2.5	32x3.5	—	—	×	—	×	—	1,400
....	....	13	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x2.5	32x3.5	—	—	×	—	×	—	1,425
....	....	11	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x2.5	32x4	—	—	×	—	×	—	1,485
....	....	11	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x2.5	32x4	—	—	×	—	×	—	1,500
....	....	11	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x2.5	32x4	—	—	×	—	×	—	1,525
....	....	10	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3	32x5	—	—	×	—	×	—	1,685
....	....	10	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3	32x5	—	—	×	—	×	—	1,700
....	....	10	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3	32x5	—	—	×	—	×	—	1,725
....	....	9	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3	36x3	—	—	×	—	×	—	1,980
....	....	9	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3	36x3	—	—	×	—	×	—	2,000
....	....	9	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3	36x3	—	—	×	—	×	—	2,030
....	....	8	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3.5	36x3.5	—	—	×	—	×	—	2,280
....	....	8	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3.5	36x3.5	—	—	×	—	×	—	2,300
....	....	8	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x3.5	36x3.5	—	—	×	—	×	—	2,330
....	....	7.5	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x4	36x4	—	—	×	—	×	—	2,630
....	....	7.5	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x4	36x4	—	—	×	—	×	—	2,650
....	....	7.5	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	32x4	36x4	—	—	×	—	×	—	2,680
....	....	7	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	36x5	36x5	—	—	×	—	×	—	2,925
....	....	7	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	36x5	36x5	—	—	×	—	×	—	2,950
....	....	7	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	36x5	36x5	—	—	×	—	×	—	2,990
....	....	6.5	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	36x5	36x6	—	—	×	—	×	—	3,175
....	....	6.5	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	36x5	36x6	—	—	×	—	×	—	3,200
....	....	6.5	5	2	3	8	—	×	—	×	—	2	—	×	—	—	—	×	36x5	36x6	—	—	×	—	×	—	3,240
....	....	12	4	2	2	8	—	×	×	—	—	5	—	×	—	—	—	×	32x2.5	32x2.5	×	—	—	×	—	—	1,080
....	....	12	4	2	3	8	—	×	×	—	—	5	—	×	—	—	—	×	36x2.5	36x2.5	×	—	—	×	—	—	1,370
....	....	10	4	2	3	8	—	×	×	—	—	5	—	×	—	—	—	×	36x3.5	36x3.5	×	—	—	×	—	—	1,710
....	....	9	4	2	8	8	—	×	×	—	—	5	—	×	—	—	—	×	36x4	36x2.5	×	—	—	×	—	—	2,090
....	....	8	4	2	8	8	—	×	×	—	—	5	—	×	—	—	—	×	36x6	36x3.5	×	—	—	×	—	—	2,620
....	....	7	4	2	8	8	—	×	×	—	—	5	—	×	—	—	—	×	36x7	36x5	×	—	—	×	—	—	2,950
36x1.7	40x2	12	4	2	2	2	—	×	—	×	—	5	×	—	—	—	—	×	32x3	32x3	×	—	—	—	—	×	1,400
34.5x2	35x2	14	4	2	2	3	—	×	—	×	—	2	—	—	×	—	—	×	36x2.5	36x2.5	×	—	—	×	—	—	2,300
35x2	38.5x2	12	4	2	2	3	—	×	—	×	—	2	—	—	×	—	—	×	36x3	36x3	×	—	—	×	—	—	2,775
40x2.5	42x2.5	10	4	2	2	3	—	×	—	×	—	2	—	—	×	—	—	×	36x4	36x3	×	—	—	×	—	—	3,570
42x3	44x3	9	4	2	2	3	—	×	—	×	—	2	—	—	×	—	—	×	36x5	36x3.5	×	—	—	×	—	—	4,390
....	....	7	4	2	2	3	—	×	—	×	—	2	—	—	×	—	—	×	36x6	36x6	×	—	—	×	—	—	5,090
36x2	40x2	14	4	2	2	3	—	×	×	—	—	2	—	×	—	—	—	×	32x3	32x3	×	—	—	—	×	—	1,450
36x2	40x2	11	4	2	2	3	—	×	×	—	—	2	—	×	—	—	—	×	34x4	34x4	×	—	—	—	×	—	1,850
34x2	40x2	14	4	2	2	2	—	×	—	×	—	5	—	×	—	—	—	×	36x3	36x3	×	—	—	—	—	×	1,250
40x2	52x2.5	11	4	2	2	3	—	×	—	×	—	5	—	×	—	—	—	×	36x3.5	36x4	×	—	—	—	—	×	1,600
40x2.5	56x3	10	4	2	2	3	—	×	—	×	—	5	—	×	—	—	—	×	36x4	36x3	×	—	—	—	—	×	2,200
44x3	56x3.5	9	4	2	2	3	—	×	—	×	—	5	—	×	—	—	—	×	36x5	40x4	×	—	—	—	—	×	2,400
....	....	14	4	4	2	6	—	×	×	—	—	7	×	—	—	—	—	×	32x2.5	34x3	×	—	—	—	—	×	....
....	....	14	4	4	2	6	—	×	×	—	—	7	×	—	—	—	—	×	34x3	34x3	×	—	—	—	—	×	....
....	....	14	4	4	2	6	—	×	×	—	—	7	×	—	—	—	—	×	34x3	38x3	×	—	—	—	—	×	....
....	....	13	4	4	2	6	—	×	×	—	—	7	×	—	—	—	—	×	36x3.5	42x3.5	×	—	—	—	—	×	....
....	....	11	6	4	2	6	—	×	×	—	—	7	×	—	—	—	—	×	36x5	36x3.5	×	—	—	—	—	×	....
....	....	9	6	4	2	6	—	×	×	—	—	7	×	—	—	—	—	×	36x6	36x4	×	—	—	—	—	×	....
....	....	12	4	2	3	3	—	×	..	..	..	5	×	—	—	—	..	..	34x3	34x3	×	—	—	×	—	—	2,250
....	....	10	4	2	3	3	—	×	..	..	..	5	×	—	—	—	..	..	34x4	34x4	×	—	—	×	—	—	2,700
....	....	7	4	2	3	3	—	×	..	..	..	5	×	—	—	—	..	..	36x5	36x3	×	—	—	×	—	—	3,240
....	....	6	4	2	3	3	—	×	..	..	..	5	×	—	—	—	..	..	36x6	36x4	×	—	—	×	—	—	3,780
38	40	14	4	4	2	4	—	×	×	—	—	3	—	—	×	—	—	×	34x2.5	34x2.5	×	—	—	×	—	—	....
....	....	12	4	4	2	4	—	×	×	—	—	3	—	×	—	—	—	×	34x3.5	34x3.5	×	—	—	×	—	—	....
....	....	9	4	4	2	3	—	×	×	—	—	2	—	×	—	—	—	×	36x4	36x3	×	—	—	×	—	—	3,000
....	....	8	5	5	2	3	—	×	×	—	—	2	—	×	—	—	—	×	36x6	36x3.5	×	—	—	×	—	—	3,500
....	....	7	5	5	2	3	—	×	×	—	—	2	—	×	—	—	—	×	36x7	36x5	×	—	—	×	—	—	4,000

ward; R. reverse. Brakes—R. W., rear wheel; R. W. J. S., rear wheel and countershaft; R. W. M. S., rear wheel and motor as tractor. Axles—1, tubular; 2, I section; 3, rectangular; 4, full floating; 5, semi-floating; 6, special; 7, frame construction; 8, herringbone gear; 5, double chain reduction; 6, shaft and worm gearing; 7, concentric gearing; 8, spur gears enclosed; 9, mo-

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UNIVERSAL SAVES SAILORS' LIVES.

Responds to Hurry Call for Lifeboats During Storm Off the Massachusetts Coast.

During a recent storm off the Massachusetts coast a schooner was in distress with no boats to go to the rescue, but a motor truck travelled 35 miles to bring aid to the imperilled sailors. The New Bedford Motor Haulage Company, dealer in Universal trucks, made by the Universal Motor Truck Company, Detroit, had a vehicle in Newport, R. I., and this was put into service. The authorities at New Bedford telephoned for lifeboats but without an idea that anything could be done.

The Universal was rushed to the dock, where two lifeboats, each 27 feet, 6.5 inches long, were loaded, one right side up and the other upside down on top of it. The boats protruded at the rear and in front to bring an even balance, and weighed 3700 pounds. The governor on the motor was disconnected and the unusual load was taken successfully and speedily to the shore in 2:10:00, reaching its destination in time to save every man of the ship's crew.

WHITES IN PASSENGER SERVICE.

Indianapolis Concern Utilizes Seven, Each of Which Has Been Driven 60,000 Miles.

The Rapidtransit Motor Company, Indianapolis, Ind., which maintains a passenger service in that city, has in service seven White chassis which has each been driven 60,000 miles in a year. The machines are used 17 hours each day and the average mileage is 150, this being the same summer and winter.

When the year had been completed the machines were overhauled and were found to be in admirable condition, there being no evidences of deterioration or abnormal wear. This was regarded as being remarkable in view of the hard service each had endured, for without regard to weather conditions the schedules were maintained. Eliminating overhead expense the cost of operation was only 4.5 cents a mile, this figure being slightly exceeded in winter. The average was 10 miles to the gallon of gasoline and 300 miles to the gallon of lubricatng oil.

ELECTRIC SERVICE WAGONS.

Development of Industry as Reflected by Number in Use in New England.

In a recent article by Day Baker, president of the Electric Motor Car Club of Boston and treasurer of the Electric Vehicle Association of America, he showed the development of the use of the electric service wagon in New Engand, which he outlined numerically as follows: 1902, two; 1903, seven; 1904, nine; 1905, 10; 1906, 17; 1907, 21; 1908, 34; 1909, 62; 1910, 119; 1911, 193; 1912, 273.

Mr. Baker emphasizes that in the 11 years covered by the figures he gives that there has been a constant development, the manufacturers profiting by perience and perfecting the machines to a st they are not only dependable and reliable, but may be considered as insuring service for a long period of years. Mr. Baker pointed out that no matter what the form of motor vehicle used its value was entirely dependent upon the system by which it was worked and the facilities for handling the freight.

CUTS HAULAGE COST ONE-HALF.

Gramm Shows Splendid Economy Over Horses in Mountainous District of California.

A large Gramm truck, made by the Gramm Motor Truck Company, Lima, O., recently sold to a transportation concern at Lake Tahoe, Cal., is doing remarkable service for its owners, according to word received by A. T. Neely, manager of the Colyear Motor Sales Company, Los Angeles, Cal., distributor for this make. The vehicle covers 50 miles a day between the railroad and Lake Tahoe and to the various resorts and camps around the lake.

All the grades in the section are extremely heavy, some of them running as high as 22 per cent., but the Gramm goes over them without difficulty. During the past few months it has been hauling fruit and general merchandise. According to a carefully prepared analysis the machine has cut the cost of transportation about one-half that which would have resulted with a horse team. During the winter the truck is being used to haul material for road making and general construction.

CANADA OFFERS GOOD MARKET.

With Rapid Increase in All Lines of Business Will Come Demand for Efficient Haulage.

E. J. Kilborn, assistant sales manager of General Motors Truck Company, Detroit, maker of G. M. C. gasoline and electric trucks, has just returned from a trip that included Montreal and other Canadian cities. He is firm in his belief that Canada will present a good future market for American made motor trucks. He states that new buildings are springing up on all sides and statistics show that every year there is an influx of settlers into Canada from the United States.

When the demands of this immense new population for household goods, implements, tools, clothing, drugs and other necessities, as well as articles of commerce that are sought in all prosperous communities, are considered, the trade increase across the border can be understood. Coincident with heavy trade and shipping, a need arises greater than ever for efficient haulage and delivery methods. There is no question that every year will see a remarkable increase of motor vehicles in Montreal, Toronto, Winnipeg and other Dominion cities that are rapidly forging ahead.

NEW SERVICE VEHICLES AND THEIR FEATURES.

Constructional Details of Machines of All Classes, the General Purpose of the Designers Being to Simplify and to Secure Protection for Moving Parts with Provisions for the Fullest Accessibility.

THE Blair Manufacturing Company, Newark, O., is building three types of service wagons that have rated capacity of 3000, 5000 and 7000 pounds, and are, aside from the motors, identical in design, although they differ in proportions. The smallest model has a water-cooled motor with bore of 4.125 and stroke of

Blair 2.5-Ton Wagon, Model D.

5.25 inches, rated at 30 horsepower, with cylinders cast en bloc, and the motors for the larger vehicles are 4.5 inches bore and 5.5 inches stroke with a rating of 40 horsepower, with the cylinders cast in pairs. These engines are lubricated by a self-contained combination of splash and force feed system which is said to be extremely efficient, and the water is circulated by a centrifugal pump. The carburetor is a Schebler model O and the ignition is a Bosch dual system with fixed spark. The clutch is a leather faced cone with cork inserts. The transmission gearset is a selective type giving three forward speeds and reverse.

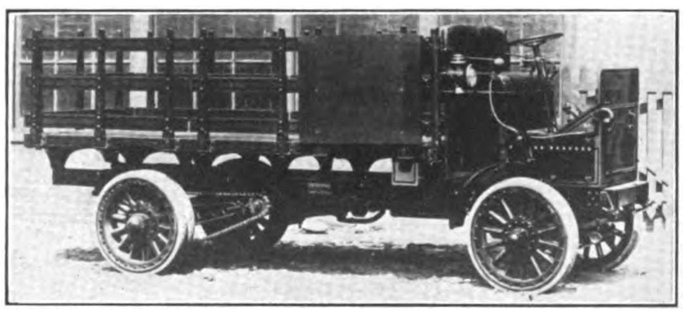
The motor is installed with the seats for the crew of the machine at either side and the hood over it may be raised by the driver without leaving his seat. This design economizes space, permits the advantages of the hooded motor and gives practically the body space that is to be found with the engine under the footboards. The drive is by a shaft and worm gear. The unusual feature of the construction is in the mounting of the motor and gearset, which is carried in a sub-frame supported by heavy cast steel brackets and hardened and ground steel pins at the forward end of the chassis frame. The rear end of the sub-frame is "necked" or cambered, and the two sturdy cross members are fitted on the steel housing of the worm drive gear, at the front and rear of the rear axle, on which housing the members may turn slightly.

As the rear axle may rise or fall from compression or recoil of the springs the sub-frame will move on the pins in the brackets on the forward end of the frame, and without stress of any kind upon the motor and driving system. As the rear axle is lifted or lowered at either side there is a slight movement of the cross members supporting the sub-frame at the rear on the worm gear housing, compensating for any change of relation and eliminating any strain upon the power plant or the driving mechanism. In other words, the sub-frame conforms to every influence that would tend to cause distortion of the chassis frame and result in deterioration. The driving force is exerted on the frame through the sub-frame. The radiator is mounted on springs and is not susceptible to the strains upon the chassis frame.

A feature of the transmission gearset is that the gears are always in mesh except when in high speed, when all the gears are idle. By a system of jaw and sliding clutch gear engagement is always easy and there is no possibility of stripping the gears. This is regarded as a highly essential quality in a service vehicle. The brakes are of liberal proportions and are all of the contracting type, the emergency on the rear wheels and the service brake on the propeller shaft. The machines are governed to what is regarded as a safe maximum speed. The steering gear is of the worm and nut type and is adjustable for wear. The front axle is a drop forged I section and the springs are semi-elliptic. The wheelbase of the 3000-pound wagon chassis is 114 and 121 inches, of the 5000-pound wagon 121 and 144 inches, and the 7000-pound truck 130 and 144 inches.

Three Universal Models.

The Universal Motor Truck Company, Detroit, Mich., is now producing three models of service wagons, of 2000, 4000 and 6000 pounds capacity. Of these the 2000-pound machine is guaranteed by the maker for 50 per cent. overload, which makes it in effect, at least, a 3000-pound vehicle. The smaller model has an L head motor cast en bloc with bore of 3.75 inches and stroke of five inches, rated at 30 horsepower. The water is cooled by a radiator of the vertical tube type with removable heads carried at the forward end of the chassis frame, and the lubricant is by the constant level splash system supplied by a gear driven pump. The ignition is by a dual high-tension installation. The



Universal Two-Ton Wagon.

clutch is a single disc dry plate type. The transmission gearset is suspended at three points and has three forward speeds and reverse. The drive is by shaft to

a worm gear contained within a full floating rear axle. The front axle is a heavy I section steel drop forging. The chassis frame is a steel channel section six inches width and .1875 inch thickness, with five cross members. This is mounted on semi-elliptic springs. The brakes are of the internal expanding type acting in drums 16 inches diameter with faces two inches width, all fully enclosed. The drive is from the left side by an irreversible gear with a wheel 18 inches diameter. The forward tires are 34 by 3.5 inches and the rear 34 by five inches. The wheelbase is 124 inches and the loading space is 108 inches by 60 or 144 inches by 60.

The two and three-ton chassis are fitted with the same motor, which is a T head type with the cylinders cast in pairs, rated at 36 horsepower by brake test at 900 revolutions a minute, having bore of four inches and stroke of 5.5 inches. The diameter of the crankshaft at the forward and middle main bearings is 1.75 inches and at the rear main bearing two inches. The main bearings are respectively four, 3.25 and 4.5 inches length. The crankcase is in two sections, the upper half carrying the main and camshaft bearings, and the lower half being the reservoir for the oil.

Wichita Two-Ton Wagon, Model B.

The motor is cooled by water driven by a centrifugal pump through a cellular radiator located under the driver's seat and by a fan incorporated with the flywheel. The lubrication is a self-contained constant level system that is circulated by a plunger pump through a sight feed on the dash. The ignition is a dual high-tension system. The clutch is a multiple disc construction that is operated dry. The transmission gearset is combined with the differential and gives three forward speeds and reverse. The drive is by side chains from the jackshaft sprockets to sprockets on the rear wheels. The chassis frame is a steel channel section six inches width with heavy cross members, and is carried on semi-elliptic springs. The external contracting service brake is located on the jackshaft, and the internal expanding emergency brake shoes are installed within drums on the rear wheels. The forward axle is an I section and the rear axle a rectangular drop forging. The wheels are 36 inches diameter and the wheelbase regularly furnished is 132 inches. The drive is from the right side by a worm and nut type steering gear and 18-inch hand wheel.

The specifications for the three-ton machine differ principally from the two-ton in the length of wheelbase, which is either 132 or 150 inches, in the weight of the material in the chassis frame, in the size of the tires and the maximum speed, which is 12 miles an hour instead of 15. The two and three-ton types are fitted with a power windlass driven by a chain from the jackshaft, which is controlled by the levers that control the machines. This is supplied as extra equipment.

Wichita Delivery Wagons.

The Wichita Falls Motor Company, Wichita Falls, Tex., is producing two types of wagon adapted for general purposes, of one and two tons capacity, which are when desired specially equipped with tanks for oil or water distribution or with apparatus for fire department service. The smaller of the two is model A and the larger is model B. The two machines are identical in design and the principal difference is in the motor, which is 3.25 inches bore and five inches stroke for model A and 3.5 inches bore and five inches stroke for model B. The wheelbase of model A is 110 inches and of model B 118 inches. The tire sizes differ, of course.

The motor is a water-cooled type with the cylinders cast en bloc and it has a crankcase of the barrel design with an aluminum oil reservoir bolted to the bottom. The timing gears are enclosed by an aluminum housing. The motor is supported by arms at either end of the crankcase. The crankshaft is unusually large with long main bearings of special nickel babbitt. The cylinders and pistons are carefully finished to insure high compression and the valves are large and have good clearance, with cast iron heads and nickel steel stems. The valves are all at the left side of the motor and are operated by a single camshaft that drives the oil pump. The camshafts are with the cams integral. The cooling is by thermo-syphon circulation and a radiator carried at the forward end of the chassis, the fan being driven by a flat belt from a pulley on an extension of the crankshaft. The lubrication is by a combination of splash and a force feed system, the oil circulating through a sight feed on the dash. The valve cover plates may be detached and the engine cleaned of carbon without dismantling the motor. The ignition is by either Bosch or Eisemann high-tension magneto.

The clutch is a leather faced cone and the transmission gearset is a selective sliding type with three forward speeds and reverse, the shafts being mounted in high duty roller bearings. The drive is through a jackshaft and side chains to the rear wheels. The forward axle is an I section drop forging and the rear axle is a rectangular steel forging. The frame is a pressed steel channel section and it is carried on semi-elliptical springs of liberal proportions. The wheels are artillery type, 34 inches diameter. The brakes are internal expanding, the service brake on the jackshaft and the emergency brake in drums on the rear wheels. The control is by a worm and sector gear at the right side with centre speed change and brake levers. The gasoline capacity is 24 gallons.

New Adams Truck.

Adams Bros. Company, Findlay, O., which is now producing 2000 and 3000-pound wagons, is manufac-

Adams One-Ton Wagon, Model A.

turing a 4000-pound machine which will be placed in the market within a very short time. The 2000 and 3000-pound machines are known as models A and D and differ principally in the size of the springs and the tires. The wheelbase of either may be 121 or 136 inches as desired. The new model will have 140 inches wheelbase and will have heavier springs and tires.

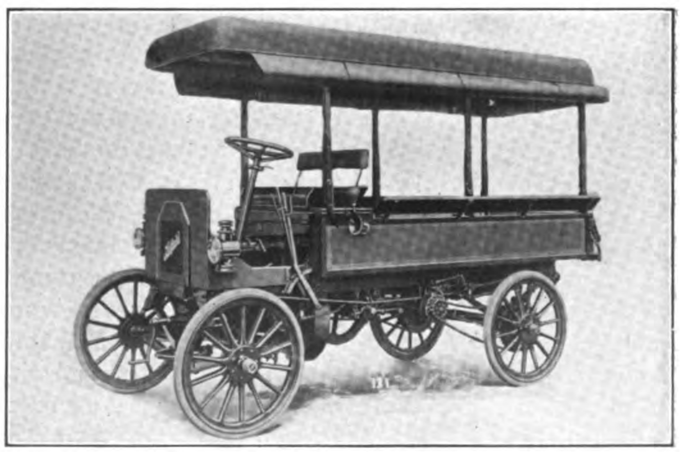
The motor is a vertical, four-cylinder, water-cooled unit with the intake at the right and the exhaust at the left, and is cast en bloc. The bore is 3.875 inches and the stroke five inches. The cylinders are so cast that there is complete circulation about the combustion and expansion chambers. The cylinders are very carefully fitted and ground and the pistons are finished with extreme care. The crankshaft is a drop forging of 3.5 per cent. nickel steel of large diameter and with unusually long main bearings. The bearings are of a special anti-friction metal of decided endurance. The camshaft is a drop forging of special steel with the cams integral, mounted on large bearings. It is actuated by spiral gears. The upper section of the crankcase carries all moving parts and the main bearings, and the lower half serves as a reservoir for oil. On a bracket at the forward end of the motor is mounted the magneto and the water pump, which are driven by a cross shaft, to which they are flexibly coupled. The lubrication is by a combination of splash and force feed and is said to be very efficient. The ignition is a dual high-tension system and the motor is cooled by water circulated by a spiral gear driven centrifugal pump through a vertical tube radiator installed back of the motor in the usual place of the dash, and a fan in the flywheel. The radiator is carried on flexible supports and is provided with two filler caps. The motor is covered with a hood that is hinged on the dash and when it is raised all parts of the engine are especially accessible.

The clutch is a multiple dry disc type and the drive is by shaft to a transmission gearset of selective design having three forward speeds and reverse that is assembled with the jackshaft. The gearset case is supported by two arms from a heavy cross member. The jackshaft shafts are not enclosed and each carries a brake drum inside the frame, on which the service brake contracts. The drive to the rear wheel sprockets is by chains. The front axle is an I section and the rear axle a rectangle, both drop forged. The frame is a wide pressed steel channel section that is "necked" between the forward wheels. The suspension is by generous semi-elliptic springs. The machine is driven from the left side by an irreversible gear of the screw and nut type with the control levers in the centre of the machine. The 2000-pound wagon is fitted with 36 by 3.5-inch tires forward and 36 by four-inch at the rear, and the 3000-pound wagon has the same size forward and the three-inch dual tires at the rear. The 4000-pound wagon will have 36 by four-inch tires forward and 36 by 3.5-inch dual at the rear.

Two Hatfield Models.

The Hatfield delivery wagons, built by the Hatfield Auto Truck Company, Elmira, N. Y., are intended to minimize cost of operation and maintenance and are somewhat unusual in design. The machines are of 1000 and 2000 pounds capacity and differ principally in spring and tire sizes and wheelbase, the former having 88 inches and the latter 96 inches. In these vehicles the front axle is of the same design that is used with an animal wagon and swings on a king bolt on a turntable. The motor is a three-cylinder, two-cycle, air-cooled type and the drive is by a driven wheel on a cross shaft that contacts with a plate attached to rear face of the flywheel of the motor. The power is transmitted from a sprocket on this cross shaft to a jackshaft, and from this by side chains to the rear wheels. There is no differential in the jackshaft; that is, a bevel gear and pinion device, but an expanding cam is enclosed in the brake drums on the ends of the jackshaft, and these are claimed to operate perfectly in making turns, and at the same time eliminating the possibility of a wheel spinning through loss of traction.

The motor is with 4.125-inch bore and four-inch stroke and is rated at 18-20 horsepower, but it is maintained it will develop 24 horsepower. Of the 99 parts of the motor but nine are moving. The cylinders are cast with wide and thin longitudinal fins and the heads are spherical. The crankshaft is a heat treated drop forging with extremely long main bearings. There are counterweights attached to insure exact balance. The



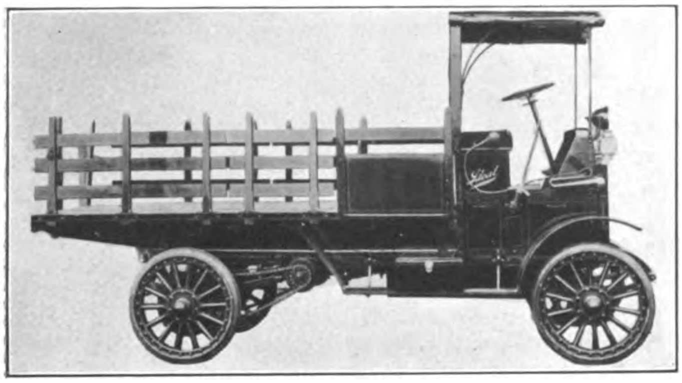
Hatfield One-Ton Wagon, Model K.

end of the crankshaft carries the magneto drive gear. The pistons are fitted with four rings, one below the wristpin. All parts are finished very accurately and

extreme care is taken to secure good compression. The ignition is by Bosch magneto and the lubrication is by oil supplied with the fuel.

Ahead of the flywheel is a heavy thrust bearing and this takes the thrust and prevents wear of the main bearings. The rim of the flywheel carries a series of blades that serve as a fan. The rear face of the flywheel is fitted with a plate of metal having a high coefficient of friction. This serves as the driving wheel and the periphery of the driven wheel on the cross shaft is faced with a fibre rim. The cross shaft is moved forward into contact with the flywheel face and transmits the engine power. Any ratio of speed can be obtained by the position of the driven wheel with relation to the flywheel.

The cylinders of the engine are covered with a light metal shield or jacket that has an opening close to a screen in the hood. There is a deck about the cylinders above the bottom of the radiating fins. The suction of the flywheel draws a current of air over the motor and down between the fins, effectively radiating the heat. The frame is of angle steel and the springs are ample. The service brake is on the jackshaft and the emergency brake is on the rear wheels. The



Ideal Two-Ton Wagon, Model G.

wheels are fitted with solid tires, 34 by three inches forward and 34 by 3.5 inches rear.

Ideal in Three Sizes.

The Ideal Auto Company, Fort Wayne, Ind., is producing three wagons, model G of 4000 pounds capacity, model H of 2000 pounds capacity and model I of 1500 pounds capacity, and of these model H has been redesigned. While its designation has not been changed a number of alterations have been made. The wheelbase has been increased from 115 to 120 inches and the engine is larger, having a bore of 3.75 inches and stroke of 5.25 inches, as against the old dimensions of 3.5-inch bore and 4.5-inch stroke, affording greater power. The frame of the former model was wood and steel, but this has been replaced by a pressed steel construction. Model G has been increased in capacity from 3000 to 4000 pounds by the use of heavier axles and springs.

Crawford Delivery Wagon.

The Crawford Automobile Company, Hagerstown, Md., is building a light delivery wagon of 1200 pounds capacity, which is intended for quick work. It is regularly delivered with an enclosed body, and is known as the model 13-30. It is equipped with either the model R Continental or the Crawford "35" motor, either having a bore of 4.25 inches and stroke of 4.5 inches, and being rated at 30 horsepower. The motor is water-cooled and is lubricated by a continuous supply of fuel from a gear driven pump. The ignition is a dual high-tension system. The clutch is leather faced with springs to insure easy engagement. There is a universal joint between the clutch and the gear set case that is enclosed in a water and dust tight case. The gearset case is supported by the sub-frame. The gearset gives three forward speeds and reverse and the shafts and gears are of nickel steel, mounted on Timken and Standard roller bearings. The torque tube at the forward end is carried by a globe and socket on the gearset case. The differential gear is constructed with four pinions, and is carried on Timken bearings. The torque tube is bolted to the full floating rear axle housing and the relation of the rear axle is preserved by radius rods. The front axle is a tubular type. The frame is a large channel section of pressed steel and it is carried on semi-elliptic springs forward and at the rear by half-scroll elliptic springs. The brakes are internal expanding and external contracting on drums 14 inches diameter and 2.5 inches face. The drive is at the right side and the control levers are at the driver's right. The tires are pneumatic, 32 by 3.5 inches forward and 32 by four inches rear.

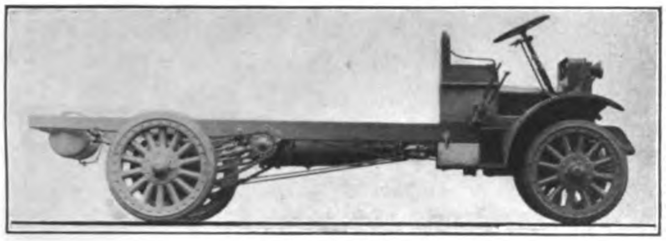
B. A. Gramm's New Designs.

The Gramm-Bernstein Company, Lima, O., with which organization B. A. Gramm is now identified, has begun the production of a two-ton wagon and a 3.5-ton truck, which are practically of the same design, and which differ principally in the size of the components, although both have the same motor equipment. There are some features of these machines that are maintained to be exclusive. One of these is the mounting of the Continental motor on a sub-frame carried by four coiled springs, another is transmission gearset having four speed ratios (for the 3.5-ton truck only), and a third is the Gray & Davis electric lighting and starting system, the storage battery of which furnishes current for ignition for an Atwater Kent unisparker. It is maintained that the engine starter will eliminate any need for the driver leaving the engine running unless it is actually needed for propulsion and will greatly economize in fuel and lubricant.

The motors are with cylinders cast in pairs, 4.5-inch bore and 5.5-inch stroke, and these and the clutches are carried on the sub-frames, which are supported by springs from the cross members of the chassis frames. The electric generator is mounted on the sub-frame and is driven by a silent chain from the pump shaft. The motor is located on the engine base and with a shaft and an over-running clutch actuates the motor through a rack on the engine flywheel. The motor is governed to a maximum speed of 1000 revolutions a minute.

The clutch is a multiple disc type with the clutch shaft discs faced on both sides with Raybestos. It is

enclosed in a dust proof housing. The inner end of the clutch is carried on a large radial ball bearing. An oilless graphite bearing is used between the housing



B. A. Gramm's 3.5-Ton Truck Chassis.

and the clutchshaft. The ball bearing needs lubrication with vaseline at long intervals. With the selective type transmission the gears are always in mesh, save when driving on the high speed. The gears of the main shaft are carried on roller bearings and the dog clutches are secured by six splines instead of the usual keys. The gears are of chrome nickel steel, the shafts of nickel steel, and both shafts are carried on annular ball bearings. The differential and gearset are in one assembly within a semi-steel case. The jackshaft is a full floating type with annular ball bearings throughout.

Timken axles, fitted with Timken bearings, are used. The frames are of pressed steel channel section of unusual width and depth and they are carried on semi-elliptic electro silica manganese springs, with improved steel shackles. The external contracting service brake operates on drums on the jackshaft within the chassis frame, and the internal expanding emergency brake shoes are within drums of large size on the rear wheels. The drive is at the right side. The dash, directly behind the radiator, carries the gauges and the indicators. Starting is accomplished by throwing the gear shifting lever into an additional position in the quadrant. The vehicles are lighted by electricity from the storage battery. Because of the design the beds of the vehicles are from six to 12 inches lower than the average, which is a quality of much importance when the load is to be handled by the driver alone. The wheelbase of the two-ton wagon is 128 inches and of the 3.5-ton truck 140 inches.

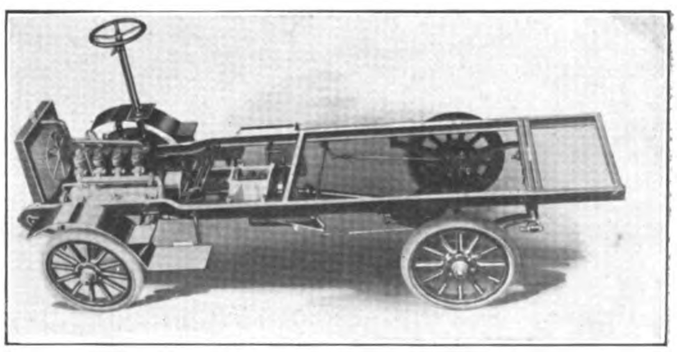
Toledo Succeeds Rassell.

The Toledo Motor Truck Company, Toledo, O., which succeeded the Rassell Motor Truck Company, is building two sizes of motor delivery wagons, one and two tons capacity. Both are much the same in general design and the components are produced by manufacturers of standards, these being the Contintal motors, Brown-Lipe gearsets, Timken front and rear axles, McCord radiators, Ross steering gears, Kinsey frames and Timken bearings. The motors and transmissions are mounted in sub-frames, which are suspended on three points and are freed from the distortion stresses that might be caused by the chassis frame without such protection. The assembly is such that the power plant can be removed from the chassis by disconnecting the water and exhaust manifolds, the fuel supply line and the throttle and spark linkage. The radiator is mounted in a cradle that is suspended on springs and it is not subjected to the strains of a fixed installation. The design is such that the motor is carried low, under the footboards and seat, yet it is extremely accessible. The carburetor, magneto, spark plugs, etc., can be reached through doors at the side of the body, and the connecting rods and the valve tappets can be adjusted without removing a bolt. The power plant of the one-ton wagon is a unit, with the transmission gearset included, but with the larger type the gearset is separate from the motor and clutch. The claim is made that these machines have very large loading spaces for the capacities, and that the loads when properly placed are so equalized as to minimize tire cost and maintenance expense.

The Practical Piggins.

The Piggins Motor Truck Company, Racine, Wis., is building three models of the Practical Piggins wagons and trucks, all of which follow a general design and differ mainly in the proportions of the components. The power plants are Waukesha motors, that of the one-ton wagon having a bore of 4.25 inches and stroke of 4.75 inches, and the two and three-ton chassis are equipped with a motor having a bore of 4.75 inches and stroke of five inches. These engines are rated at 30 and 40 horsepower, respectively, and are designed for a maximum of 1000 revolutions a minute. Accessibility is a feature of the design and the motor can be easily removed from a chassis after the radiator has been taken off.

The clutch is a cone type and the transmission gearset is a selective type with sliding clutches, in which all gears are constantly in mesh, the gears being of liberal size and the shafts carried on ball bearings. Directly back of the transmission case, on the extension of the transmission shaft, is the service brake. Coupled to this shaft by a universal joint is the driving shaft, which is enclosed in a tubular housing, and this housing is incorporated with a case that encloses a differential gear and the supplementary or countershaft. This shaft assembly is fitted with a large arm at either end which will turn on a wide babbitted bearing, and the other ends of the arms are secured to the squared rear axle. As the tubular hous-



Practical Piggins Three-Ton Truck Chassis.

ing is raised or lowered at the forward end its relation is always preserved and there is no stress upon the driving shaft. The ends of the countershaft carry

spur pinions that mesh with spur gears mounted on sleeves to which the wheels are secured.

The axle spindles are fitted with roller bearings of large size. The gears are enclosed in housings and are lubricated with a heavy grease. It is claimed for this construction that as the gears are of vanadium steel, heat treated, they have very long life. The weight of the vehicle and its load is carried on the dead axle and the stresses through road conditions are eliminated. The front and rear axles are high grade carbon steel forgings and are fitted with nickel steel spindles. The emergency brake is the internal expanding type and operates within drums on the rear wheels. The frame is a large channel section with generous cross members, the parts being drilled and assembled with rivets headed while hot.

Bessemer Increases Its Line.

The Bessemer Motor Truck Company, Grove City, Penn., has increased the number of its models to three, the capacities being 1000, 2000 and 3000 pounds. The first wagon built was of 2000 pounds capacity. These machines are practically to the same design and two sizes of motor are used, that for the smallest wagon, known as model A, being a vertical, four-cylinder, wa-

Bessemer One-Ton Wagon, Model B.

ter-cooled type with bore of 3.5 inches and stroke of 4.5 inches, and a horsepower rating of 18. Models B and C have a motor with bore of 3.75 and stroke of 5.25, rated at 22 horsepower. The motor capacity is reached at 1000 revolutions. The water circulation is by a centrifugal pump and it is cooled by a radiator and a fan. The lubrication is by a gear driven pump and the ignition is by a Briggs magneto. A Rayfield carburetor is used.

The clutch is a cone with a leather face and the transmission gearset is a selective sliding gear type having three forward speeds and reverse. The drive is by shaft, jackshaft and side chains to the sprockets on the rear wheels. The frame is a pressed steel channel section of liberal proportions and it is carried on semi-elliptic springs. The axles are steel drop forgings, the front axle of model A being square and the front axles of models B and C being I sections, while the rear axles are rectangular in form. The brakes are internal expanding and operate within drums on the rear wheels. The wheelbases of the models are 102, 120 and 136 inches, respectively.

The design of these machines has been with a purpose of securing accessibility of all the components, minimizing the labor that is necessary in giving the needed care and attention, and liberal allowance has been made to provide for wear and to insure long endurance under all conditions of service.

The New King 3.5-Ton Truck.

The A. R. King Manufacturing Company, Kingston, N. Y., has begun the manufacture of a 3.5-ton truck known as the King, which in general features follows conventional practise. The wheelbase is short through the power plant being mounted under the driver's seat. Emphasis is made of the high quality of material and workmanship entering into the construction and of the provisions made to insure against wear and deterioration. The motor is a four-cylinder, four-cycle, water-cooled, L-head type with bore of 4.5 inches and stroke of 5.5 inches, having a rating of 32.4 horsepower by the S. A. E. standard. The cylinders are cast in pairs. The motor is cooled by water circulated by a centrifugal pump through a vertical tube radiator and a large belt driven fan. The lubrication is by a self-contained force feed system, the oil being circulated through a sight feed on the dash to the crankcase, where it is distributed to the moving parts by splash, and the overflow is drained to the reservoir and is filtered and again used.

The ignition is by Bosch dual system with a set spark. The clutch is a multiple disc construction with the 21 steel plates faced with Raybestos. The engine and clutch are mounted as a unit in a sub-frame that is supported at three points, and this assembly may be removed from the front of the chassis without removing the seats or footboards. The end of the clutch shaft is supported by a roller bearing in the sub-frame, which prevents strain upon the rear bearing of the engine. The transmission gearset is selective, with three forward speeds and reverse, and the wide faced gears are always in mesh, the engagement being by sliding jaw clutches, so that gear stripping is impossible. The differential is assembled as a unit with the gearset, and the suspension of the assembly is by three points. The final drive is by double side chains from the jackshaft sprockets to those mounted on the rear wheels, the rear sprockets being detachable.

The frame is a rolled steel channel six inches width, and generous depth, and this is carried on semi-elliptic springs of Krupp steel, 44.5 inches length forward and 54 inches length rear, fitted with inch bolts of nickel steel, hardened and ground. The front axle is an I section drop forging of steel, and the rear axle is a rectangular section 2.75 by three inches. The wheels are artillery type fitted with demountable rims carrying 36 by six-inch tires forward and 36 by eight-inch dual tires rear. The radius rods are steel castings, mounted concentric with the sprockets, giving a constant chain tension under all loads. These rods are adjustable at the head.

The external contracting service brake shoes act on 10-inch drums on the jackshaft, and the internal expanding emergency brake shoes operate within 18-inch drums on the rear wheels. Both sets of brakes are equalized. The steering gear is an irreversible

type with a 22-inch hand wheel. The throttle lever is mounted on the steering column. The motor is governed to a maximum speed of 12 miles. Timken roller

United States Three-Ton Truck, Model D.

bearings are used in the steering knuckles, hubs and jackshaft hangers, and imported annular ball bearings in the transmission. Abundant provision is made for lubricating all the moving parts and for adjustment to compensate for wear. The wheelbase is 120 inches and the tread is 62 inches forward and 64.5 inches rear. The body platform is 156 inches and 72 inches, maximum length and width.

Features of United States Trucks.

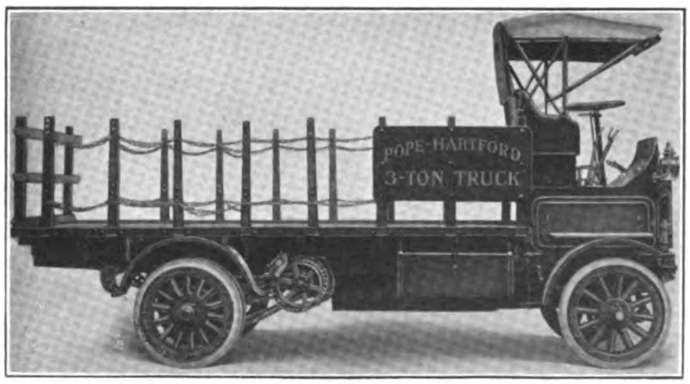
The United States Motor Truck Company, Cincinnati, O., is producing two models—type D of 6000 pounds capacity and type E of 4000 pounds—which are generally of the same design and differ practically in the proportion of parts. The machines conform to conventional practise, but for them special qualities are claimed in design of the transmsision gearset, in which the gears are always in mesh; in the suspension of the gearset case, this being a unit assembly with the jackshaft and mounted forward in a ball socket fitted to a cross member of the chassis frame, and with the ends of the jackshaft carried in globe sockets in the supporting brackets; in the straight line drive from the engine to the jackshaft; in the spring suspension of the motor; in the form of brake equalizer; in the metal seat frame and side panels; in the mounting of the radiator on springs; in the method of attaching the brake drums to the rear wheels with a clip around every spoke; in the demountable rims with which the wheels are fitted. The motors differ, that of the smaller vehicle being with cylinders cast en bloc with bore of 4.125 inches and stroke of 5.25 inches; that of the larger having cylinders cast in pairs with bore of 4.5 inches and stroke of 5.5 inches. The horsepower ratings are respectively 27.25 and 32.4. The rear axle of the 4000-pound machine is a round section and that of the 6000-pound chassis is rectangular. The wheelbase of model E is 132 inches and of model D 144 inches. Both machines have 36-inch wheels and the tires are respectively 3.5 and five inches for the forward wheels and 3.5 and five inches dual for the rear wheels.

New Five-Ton Pope-Hartford.

The Pope Manufacturing Company, Hartford, Conn., will build three and five-ton machines for the year to come. The smaller type has been considerably changed when compared with the 1912 vehicles, while the larger is new in every respect. The difference between the two, however, is practically a matter of chassis component proportions, for the same motor is used in both models. The results of experience and development have been combined in the two products and they are believed to be fitted to meet every requirement of service for which such vehicles could be utilized. As compared with the three-ton truck of 1912 the same type has been improved by an increased wheelbase, a transmission having four forward speeds and reverse, the use of locomotive type brakes on drums carried on the jackshaft, and other details of less prominence. The longer wheelbase permits the installation of bodies with larger carrying space, the fourth speed allows a greater range of effective power application, and the directly applied brake shoe is believed to be the more efficient.

The motor is the same in both models, being a four-cylinder, water-cooled, vertical type with the cylinders cast in pairs, and with bore of 4.75 inches and stroke of 5.25 inches. These are rated at 50 horsepower. The motor is cooled by a Pope-Hartford radiator of planetic type, the water being circulated by a centrifugal pump, gear driven, the system having a capacity of 8.25 gallons. The radiator is suspended in the chassis frame so that it is free from all torsional stresses. A belt driven fan cools both radiator and engine. The motor is lubricated by splash from reservoirs beneath the crankpins in which oil is maintained at a predetermined height by a suction pump. The excess oil is drained to the main reservoirs and after filtration is again circulated. The ignition is by a dual system, with an Eisemann high-tension magneto, with automatic spark advance. The motor is mounted on a subframe and is accessible through removable side panels of the housing.

The clutch is a cone, 17.75 inches diameter and 2.875 inches face, covered with a material having a high coefficient of friction. The transmission is a sliding gear type with four forward ratios and reverse, with direct drive on the fourth. The differential is a spur gear construction, with chrome nickel steel gears and large shafts, enclosed in the jackshaft housing. The drive to the rear wheels is by side chains. The

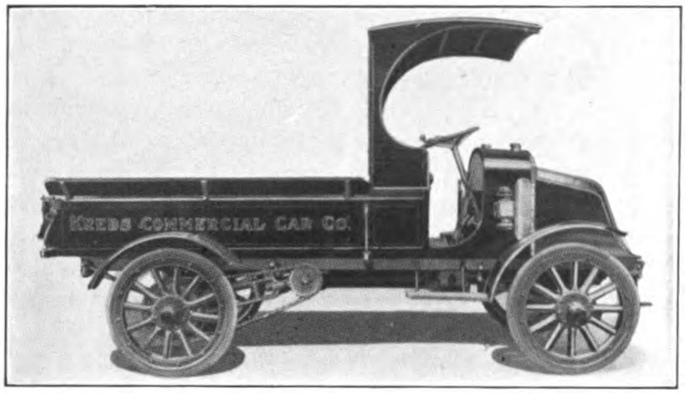


Pope-Hartford Three-Ton Truck.

springs are semi-elliptical with two heavy duty helical auxiliary springs located over the rear axle that come into use when the vehicle is heavily loaded. The for-

ward axle is an I section of unusually heavy construction and the rear axle is a rectangular section of large proportions. The service brake shoes contract on the drums on the jackshaft and the emergency brake shoes expand within drums on the rear wheels.

The control is by a steering wheel at the left side, 22 inches diameter; the throttle lever is under the wheel on the steering column, the left pedal operates the clutch and the right the service brake. The foot accelerator is convenient to the other pedals. The brake and gearset levers are at the driver's right. The three-ton model has 36-inch wheels fitted with demountable rims; the five-ton truck has 36-inch forward wheels and 42-inch rear wheels, with demountable rim equipment. The wheelbase is 138.5 inches for the three-ton machine, or a special chassis is built with 160 inches wheelbase. The tread of the three-ton truck is 67 inches forward and 68 inches rear. The five-ton truck has a wheelbase of 140 or 160 inches, and a tread of 67 inches forward and 74 inches rear. The speeds are 12 and 10 miles an hour for the small and the large truck, respectively. These machines are sold with



Krebs 1500-Pound Wagon, Model A.

standard type bodies and with either cab or buggy tops.

Krebs Delivery Wagons.

The Krebs delivery wagons, built by the Krebs Commercial Car Company, Clyde, O., are designated as models A and B, the former having a capacity of 2000 pounds and being driven by side chains, and the latter a capacity of 1500 pounds and being driven by a shaft. Model A is fitted with solid and model B with pneumatic tires. Model B is the faster of the two machines. In other details both are the same.

The motor is a two-cycle, water-cooled, two-cylinder unit with bore of 4.5 inches and stroke of five inches, that is rated at 16.2 horsepower and will, it is claimed, develop 24. The maximum of revolutions a minute is 900. The motor is exceedingly simple in construction and is mounted so that by the loosening of eight bolts it may be removed from the chassis frame. It is cooled by circulation of water by thermo-syphon through the water jackets and a radiator that is incorporated with the dash, and by a fan driven by a belt from a pulley on the crankshaft extension. The lubricating oil is fed with the fuel and the ignition is by Bosch high-tension magneto. The motor is covered with a hood of the conventional Renault type.

A cone clutch, of which the flywheel is a member, is used, and the power is transmitted through a selective sliding gearset with three forward speeds and reverse, and thence by a propeller shaft direct to the rear axle of the full floating design, or to a jackshaft. The model A rear axle is a rectangular drop forging. The model B rear axle is fitted with New Departure ball bearings and the shaft is designed with two universal joints. The frame is of pressed steel channel section four inches width and two inches depth, of .1875 inch thickness. The springs are semi-elliptical and the wheels are fitted with 34 by three-inch solid or 34 by four-inch pneumatic tires. The wheelbase is 100 inches with either model. The drive is from the left side with centre control levers.

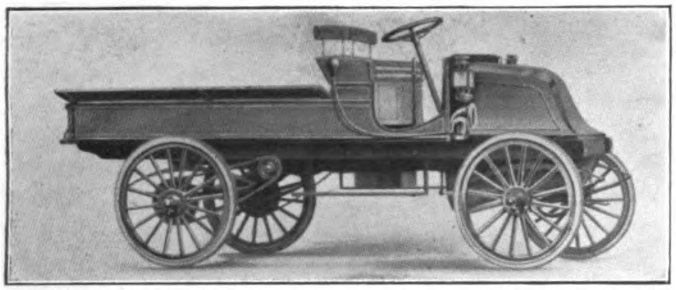
Brockway Wagons.

The Brockway Motor Truck Company, Cortland, N. Y., has announced the production of three types of wagon chassis adapted for differing business purposes. These have been perfected with a view of meeting the requirements of those who desire economical and dependable vehicles, and the development has extended over a period of about five years. The model A chassis is rated at 20 horsepower and its motor is a two-cycle, three-port, air-cooled, vertical type, with three cylinders of four-inch bore and five-inch stroke. The motors have but seven moving parts, the pistons, connecting rods and the crankshaft, and are extremely simple in construction. The cylinders are cast separately of a special quality of fine gray iron and are rough bored, annealed and ground to size. The pistons, of the same material, are specially treated to maintain the quality and to insure an accurate fit. The wristpins are large and are fitted to the pistons with Woodruff keys and cottered.

The crankshaft is large diameter and of a special alloy steel. All the engine bearings are bronze and well fitted. The engine case is provided with liberal hand-holes for the adjustment of the connecting rod bearings. The fan bladed flywheel is keyed to the crankshaft. The engine is cooled by a circulation of air drawn through openings in the Renault type of hood, a draft being insured by the shield that protects the lower section of the engine case. The carburetion is by a carburetor of the automatic float feed type and the lubrication is by oil mixed with the fuel, there being one part of lubricant to 20 parts of gasoline. The ignition is by a Bosch magneto with fixed spark. The power plant is mounted in the forward end of the chassis with a universal connection at the front and by arms at the rear.

The drive is through a cone clutch and a planetary reduction gearset giving two forward speeds and reverse, the entire assembly running in a bath of oil, a jackshaft and double side chains to sprockets on the rear wheels. The chassis frame is of wood reinforced with steel angles, and is maintained to be specially strong and efficient. The springs are full elliptic, front and rear. The axles are steel forgings, with large spindles. The wheels are artillery type, 36 inches

diameter front and 38 inches diameter rear. The brakes are internal expanding on the rear wheels. The control is with a throttle lever on the steering wheel,



Model A Brockway, 1000 Pounds Capacity.

low speed with the left pedal, reverse with the right, brake with the centre pedal and the hand lever for high speed. The steering gear is an irreversible worm and sector type. The wheelbase is 100 inches and the tread 58 inches.

The model B chassis differs from the model A in that the drive is through a gearset of a selective type giving three forward speeds and reverse, and the clutch is a leather faced cone. The sizes of the axles are increased and the wheelbase extended to 106 inches. The service brake is internal expanding on the jackshaft, and the emergency brake of the same type on the rear wheels. The control follows standard practise as regards pedals and levers. The model C chassis has a motor with cylinder bore of 4.5 inches and stroke of five inches, rated at 30 horsepower, and it has a wheelbase of 112 inches. In other respects it resembles the model B. Model A is rated at 1000-1500 pounds capacity; model B, 2000-2500 pounds capacity, and model C, 3000-3500 pounds capacity.

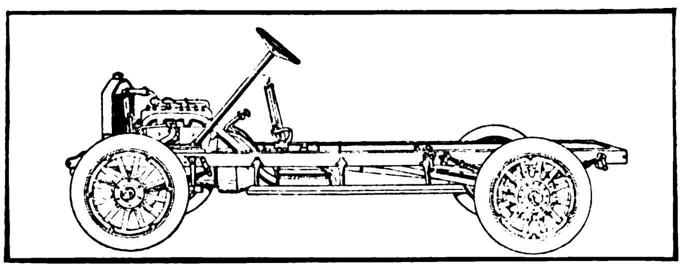
Brown Commercial Car.

The Brown commercial car, built by the Brown Commercial Car Company, Peru, Ind., is a new product and but one type, of 1500 pounds capacity, has been placed in the market. This is sold fitted with stake platform, covered express or fully enclosed body. The wheelbase is 122 inches and the tread 56 inches. It is a conventional design and the drive is by shaft from the transmission gearset to a jackshaft mounted back of the rear axle and by pinions on this shaft meshing with internal gears on the rear wheels.

The motor is a four-cycle, vertical, four-cylinder, L-head type with the cylinders cast en bloc, with bore of 3.75 inches and stroke of 5.25 inches, having a horsepower of 22.5 by the S. A. E. rating. The intake manifold is cast integral with the cylinders, heating the mixture before it is supplied to the combustion chambers. The crankcase is divided longitudinally and the lower half contains the oil reservoir, the upper half supporting the main bearings. The pistons are fitted with four rings. The crankshaft is a drop forging of .35 carbon steel, heat treated and ground, 1.75 inches diameter, mounted in three main bearings, respectively, 2.75, three and four inches length, of Parsons' white bronze. The connecting rods are the same material and have big end bearings 2.5 inches length and wristpin bearings one inch diameter, the bushings being of Parsons' white bronze.

The lubrication is by two plunger pumps driven by eccentrics on the camshafts by which the oil is pumped through tube to the timing gears and main bearings. The drainage maintains a constant level in the base of the engine case and splash lubricates the crank pins, wristpins, camshaft bearings, valve tappets, pistons and cylinders. The overflow drains to the reservoir, where it is filtered and used again. Draining the oil reservoir and cleaning the filter is provided for. The motor is cooled by a circulation of water by a centrifugal pump through the large water spaces of the motor, the vertical tube radiator supported on coiled springs, and by a fan driven by a belt from the forward extension of the crankshaft. The carburetor is an automatic float feed type with throttle on top of steering wheel, and ignition is by a Remy RD magneto.

The clutch is a multiple dry plate type with the plates faced with anti-friction material. The transmission gearset is a selective design with three forward speeds and reverse, with large shafts carried on imported annular ball bearings and with gears of 3.5 per cent. nickel steel. The engine, clutch and gearset are assembled as a unit. Both the emergency brake and the speed changing levers are mounted with the power plant and are free from stresses from chassis distortion. The driving shaft from the gearset to the rear axle is 1.75 inches diameter, with two universal joints, and is enclosed in a torque tube. The relation of the rear axle is maintained by two tubes extending from the brake spiders on the rear axle to a cross member of the chassis, the globe forward ends being mounted in bronze bushed sockets. There is ample provision for adjustment. There is the usual bevel gear differential in the jackshaft. The frame is pressed steel and mounted on semi-elliptic springs, 40 by two inches forward and 50 by two inches rear. The front axle is an I section, drop forged, with drop forged heat treated nickel steel spindles, fitted with annular ball bearings. The rear axle is drop forged steel and the spindles are equipped with annular ball bearings. Large annular ball bearings and large shafts are used in the jackshaft. The solid axle carries the load of the vehicle. The wheels are artillery type,



Brown Commercial Car, 1500 Pounds Capacity.

with large spokes, and are shod with 34 by 3.5-inch Motz tires forward and four-inch Motz tires rear, or with 34 by 4.5 pneumatic shoes on demountable rims.

Knickerbocker Five-Ton Model.

The Knickerbocker Motor Truck Company, New York City, is building a five-ton truck that is desig-

Knickerbocker Five-Ton Truck, Model 12-5.

nated as 12-5, and which is to the same design of the 3.5 and four-ton trucks that this concern has built during the last year. It has the quality of extreme accessibility with reference to radiator, motor, clutch, steering gear, gearset and jackshaft, and it is possible by swinging the radiator and loosening the connections to draw out the power plant, which is mounted on a hickory sub-frame. It is maintained that the hickory sub-frame absorbs the vibration from road shocks to which the motor would ordinarily be subjected, and that it also lessens the degree of engine vibration and its influence upon the other components of the chassis. The transmission gearset is designed to have the gears constantly in mesh and the sliding jaw clutches take the strain equally instead of the stress of starting being upon several teeth of a gear. It is a selective type with three forward speeds and reverse. The gears and shafts are chrome nickel steel and the bearings are the imported separated annular type. On direct drive all gears are idle. The jackshaft is a full floating form contained in a one-piece pressed steel housing, and it is fitted with Timken bearings.

The motor is of the L head type with the cylinders cast separately, with bore of 4.75 inches and stroke of five inches. It is cooled by a circulation of water that is forced through a large radiator by a centrifugal gear driven pump and a belt driven fan. The lubrication system is a combination force feed and splash. The pistons, of unusual length, are fitted with five rings. The crankshaft is 1.875 inches diameter and has five liberal main bearings. The wheelbase is optional with the purchaser.

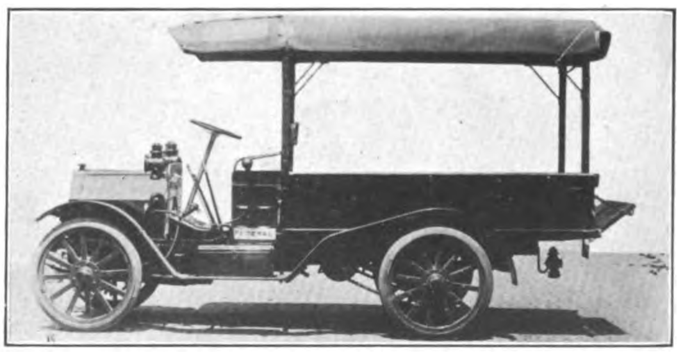
Federal of Standard Design.

The Federal Motor Truck Company, Detroit, Mich., has made no change whatever in the design of the machine it is producing, and it has been practically standardized, although they are specified as models C and D. The only difference is in the length of wheelbase, which is 110 inches in the former and 144 in the latter, and the longer chassis is approximately 100 pounds heavier than the shorter. The motor is a four-cylinder, water-cooled type with cylinder bore of 4.25 inches and stroke of 4.5 inches, the cylinders being cast in pairs. The valves are on the left side. The water circulation is by a gear driven centrifugal pump and the lubrication is by the constant level splash system. The crankshaft has three large bearings and is of unusual size. The ignition is by a high-tension magneto with fixed spark and the gas is controlled by an accelerator pedal.

The motor, clutch and the transmission gearset and the jackshaft are arranged as units and are unusually accessible. The gearset case and the jackshaft housing is a single assembly and these may be removed with comparatively little labor. The radius rods are a special design in which relation of the rear axle and jackshaft is always maintained and the stresses of driving are eliminated from the springs. The radius rods, brakes, steering gear and control members are adjustable from the outside with minimized labor. The axles, axle bearings, wheels, chains and sprockets are much heavier than is the standard practise with vehicles of the same capacity. The rear sprockets and the hub brake drums are a unit, and the drums are secured to the spokes of the wheels by North bolts, one through each spoke. The wheels are unusually heavy construction. The drive is left side with the speed and brake levers outside of the machine. The control by the pedals and the accelerator leaves the driver's both hands free to handle the wheel.

Standard Motor Trucks.

The Standard Motor Truck Company, Detroit, Mich., has placed in the market the Standard truck of three tons capacity, which, it is announced, is a combination of standard components and design, the result of the development by experts since the inception of the industry. The machine reflects all the standards of the S. A. E. as well as the experience and knowledge of the designer. The truck is conventional throughout, it including Continental motors, the gearset transmission of the Brown-Lipe Gear Company, Timken jackshaft and axles, Gemmer steering gear and Perfection springs. The purpose of the builder is to produce a vehicle that will be in every way accessible and enduring and afford a very large measure of practical service. The machine is built in a stand-



Federal One-Ton Wagon, Model C.

ard wheelbase of 144 inches and in special chassis of 120, 168 and 192 inches. With four lengths of chassis frame the buyer has the option of loading space from

102 inches with the shortest to a maximum of 255 inches with the longest, or 12 different possibilities—three with each chassis.

The motor is a four-cylinder, L head, water-cooled type with bore of 4.5 inches and stroke of 5.5 inches, rated at 40 horsepower. The power plant, clutch and gearset is a unit, and it may be taken out without hoisting by removing the radiator and forward cross frame member that serves as a bumper. The motor may be governed to a maximum speed of from 600 to 1000 revolutions a minute. The cylinders of the engine are cast in pairs. The motor is cooled by water circulation and a radiator and 18-inch fan. The lubrication is by a positive plunger pump system with one lead of tube to the timing gears and another to the rear main bearing. The ignition is by an Eisemann magneto with automatic spark advance.

The clutch is a multiple dry disc type, the plates being faced with Raybestos. The transmission gearset is selective, with three forward speeds and reverse, with all gears and shafts of 3.5 per cent. nickel steel, heat treated, the shafts operating on Timken roller bearings. The drive from gearset to the jackshaft is by a shaft fitted with two universal joints. The jackshaft is contained in a pressed steel housing with shafts and gears of nickel steel, mounted on Timken roller bearings. It is a single assembly and may be easily removed. The frame is a six-inch channel section of pressed steel .4375 inch thickness. It is carried on semi-elliptic springs, 45 by 2.5 inches forward and 52 by 3.5 inches rear. The radius rods are steel castings of wide section and are swivelled close to the jackshaft to prevent stresses from either vertical or transverse action of the axle or chassis. There is no strain upon the adjusting screws. The axles are the Timken standard and fitted with wheels shod with 36 by five-inch single tires forward and 36 by five-inch dual rear tires. The rims are demountable.

The service brake of the external contracting type acts on drums on the jackshaft, and the emergency brake, operated by a hand lever, expands shoes in the 18-inch pressed steel drums on the rear wheels. The speed changing and the emergency brake levers are located at the centre of the machine on the cover of the gearset case. The steering gear is a worm and sector operated by a 20-inch hand wheel. The moving parts are all fitted with large grease and oil cups and there are means for adjustment throughout.

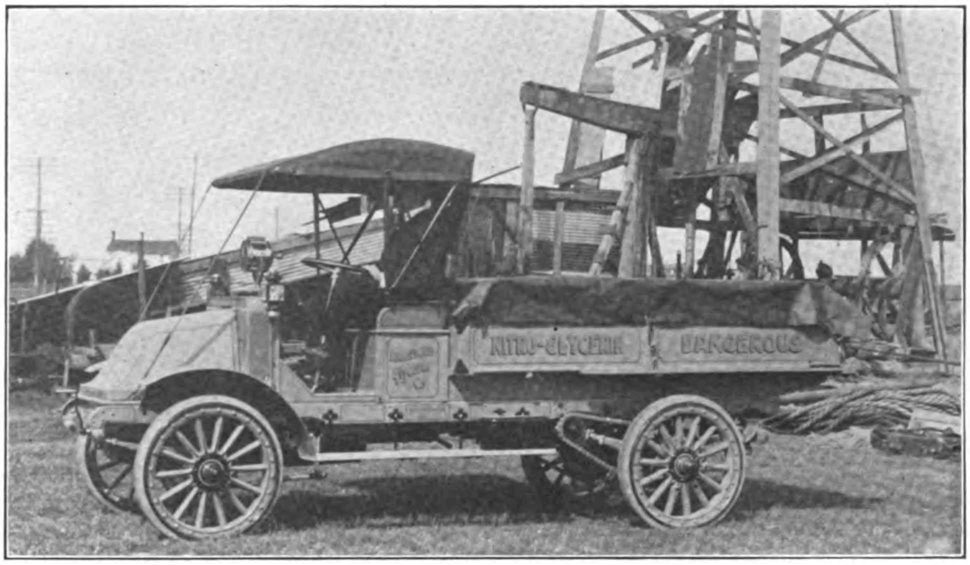
The new city administration of Haverhill, Mass., has recommended motorization of the fire department.

ADAMS HANDLES NITROGLYCERIN.

Special Bodies Fitted to Regulation Chassis with Satisfactory Results in This Field.

The American Glycerin Company is delivering nitroglycerin to the oil well regions in Adams trucks, made by the Adams Bros. Company, Findlay, O., and an accompanying illustration shows one of these vehicles about to deposit its load of 720 quarts of the explosive and the shells used for lowering it into the wells. The handling of this product is of interest to those who are unfamiliar with the characteristics of nitroglycerin.

The explosive is marketed in two forms, one being that in which it is mixed with some porous substance and formed into sticks, known as dynamite, and the other in the liquid state. In the latter instance it is carried in cans, not unlike those used for maple syrup. These usually are packed in sawdust to avoid the possibility of shock. Nitroglycerin may be burned in an open vessel without danger, but when heated in a closed can it will form a highly explosive gas. It usually is exploded by detonation.



Adams Truck Utilized by American Glycerin Company for Handling High Explosives.

Certain precautions must be taken in providing a suitable truck body, such as the use of special shock absorbing springs, pneumatic tires, etc., but the chassis utilized in this instance is the regular stock Adams product. Records of operation indicate that the Adams truck has an efficiency of two-thirds more work than with horses.

The Standard Glass Company, Chicago, recently purchased a Buick light delivery truck, made by the Buick Motor Company, Flint, Mich., which has since been used for the transportation of plate glass, and during the nine months of its service no injury has been caused to goods. W. L. Eaton of the firm was pessimistic about the success of the experiment, but he is well pleased with the results obtained.

ADVANTAGES OF THE RECORDING DEVICE.

Instruments Designed to Aid the Owner to Realize Maximum Efficiency from His Equipment —The Taximeter, and Its Counterpart on Mechanical Transports.

BEFORE the advent of the mechanical transport, the large majority of business men seemingly gave little thought or study to the question of transportation. Horses were employed for local haulage, and goods that were to be sent longer distances were shipped by freight or express. Slight attention was paid to the item of cost, it apparently being assumed there were no other methods available. Even the men engaged in supplying the necessary horse transportation were unable to state definitely whether they were doing business at a loss or a profit.

When the motor truck salesman appeared with his statements respecting cost a ton-mile, etc., he found in many instances that men who were familiar with every detail concerning the cost in other departments had no data at hand upon which to base a comparative estimate. All this has been changed, and it is now held to be possible to determine with every degree of accuracy whether a given installation, be it motor vehicles or horse wagons, is a paying proposition.

Two Views of International Taximeter, Indicating Separate Totalisers and Their Functions.

It may be assumed for the purposes of this discussion that a department store is investigating the possibilities of motor vehicles as applied to its delivery system and as compared with horses. It may be, and doubtless is true in many instances, that electrics possess certain advantages over gasoline cars in such work. It will be conceded that if this firm can be placed in a position to know absolutely what it will cost to operate each type of vehicle, or better still each vehicle, it then will be able to act upon such information, both in the purchase of equipment and in the arrangement of its delivery system to meet the requirements which will be disclosed.

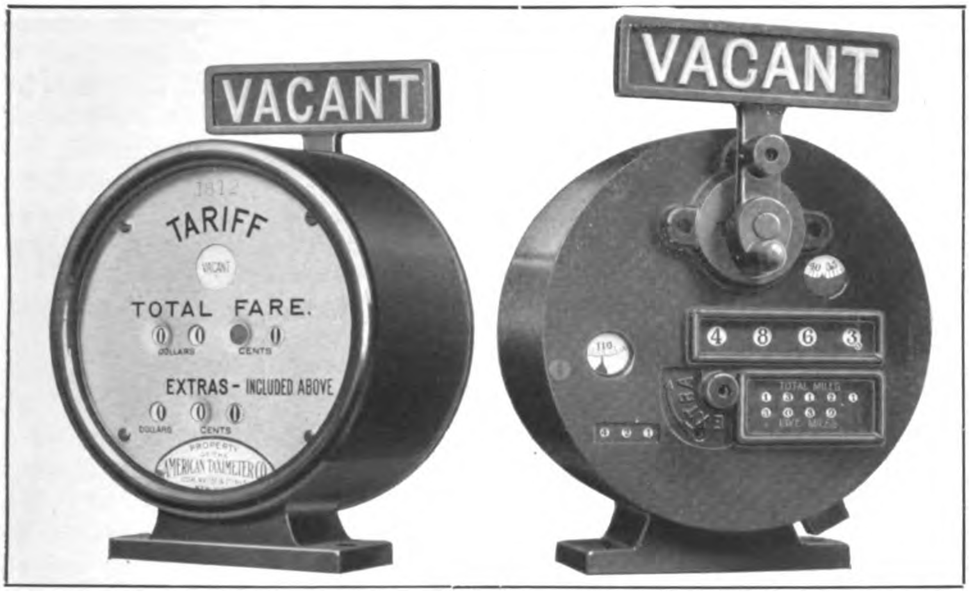
Many transfer companies have become convinced that the motor truck offers advantages, particularly in long haul work, which merit careful investigation. But if they have been engaged in transportation service for years with horses without being able to tell definitely whether or not they were making a profit on the individual job, feeling satisfied if the aggregate of the year's business showed a balance on the right side of the ledger, they hardly can have acquired the information they desired in this connection. As with the department store it becomes necessary to secure accurate data as to the cost of each piece of work, so far as that may be determined.

The list might be continued indefinitely. It is sufficient to state that concerns doing a large haulage business find this kind of information so valuable that they are willing to enlist the services of experts in securing the required data. And if it is of value to such companies, it must follow that those who have less capital involved, and consequently must be careful to obtain the maximum efficiency from their equipment, will find a study of this subject of direct personal interest.

The taxicab may be selected as presenting certain phases of the problem, the solution of which will indicate in a measure what is desired. The taxicab is returning money on the investment only when it is engaged. The reduction of the so-called dead mileage is of prime importance, but it is necessary to learn other details, and for this purpose taximeters are installed upon the vehicles.

These instruments are designed to record the fare, covering the mileage, waiting time and extras, or incidentals. In addition, they present to the owner a complete and accurate account of his vehicle while in service. Every effort is made by their manufacturers to produce a reliable recorder, which shall faithfully perform its function in these two particulars, at least.

Herewith are presented a number of taximeters on the American market, and with each the object sought is the same, although the method of their operation may differ slightly. Briefly, when the flag is exposed in an upright or prominent position, the vehicle is for hire. When this flag is lowered the initial charge is marked up on a certain dial, and thereafter the various items of the charge are added in sequence until the total fare is paid and the vehicle is dismissed.



Front and Rear Views of Jones Taximeter, Showing Owner's Check on Vehicle's Earnings.

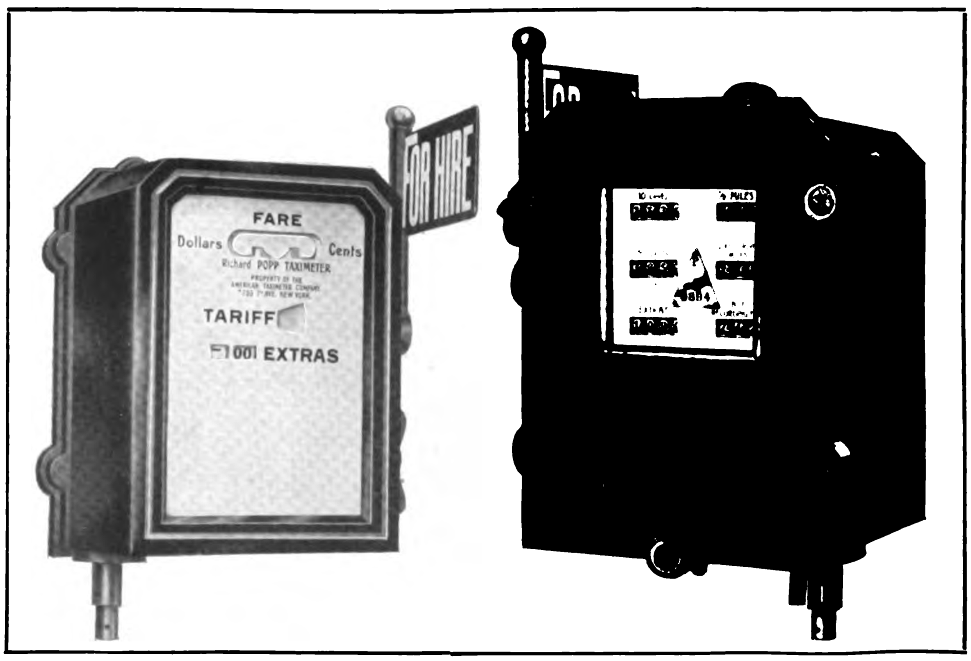
Two views of the International, made by the International Taxameter Company, 230 West 68th street, New York City, are shown. The first indicates that the cab is for hire. The second presents the condition of the record at the moment the vehicle is engaged. As the flag is lowered an initial charge of 40 cents for the first half-mile appears in the opening marked "Fare." A further reading of the instrument shows that there is a charge of 20 cents for "extra"; the initial totalizer at the bottom reads 0213 instead of 0212, one number greater than before the flag was dropped; the extra totalizer shows at 0266 instead of 0265, while the fractional totalizer registers the same, 8465, because no fraction of a mile or waiting time has been registered as yet. These totalizers remain in full view and cannot be set back.

In addition, the construction is such that there is a record by tenths of a mile for total mileage and another for dead mileage. A non-recording feature also is included, but this is limited and automatic. Once this mechanism is set in operation, the taximeter is placed beyond the control of the driver. When the limited period is completed the meter reverts to recording time or mileage, according to the conditions under which the machine is working. For instance, in case of accident, when necessary to make repairs: After 20 minutes the non-recorder automatically resets and the meter resumes its function. No matter what attempt might be made to prolong the non-recording period, it would be ineffective unless a new initial charge were recorded, in which event the initial amount registered would be chargeable to the driver of the vehicle.

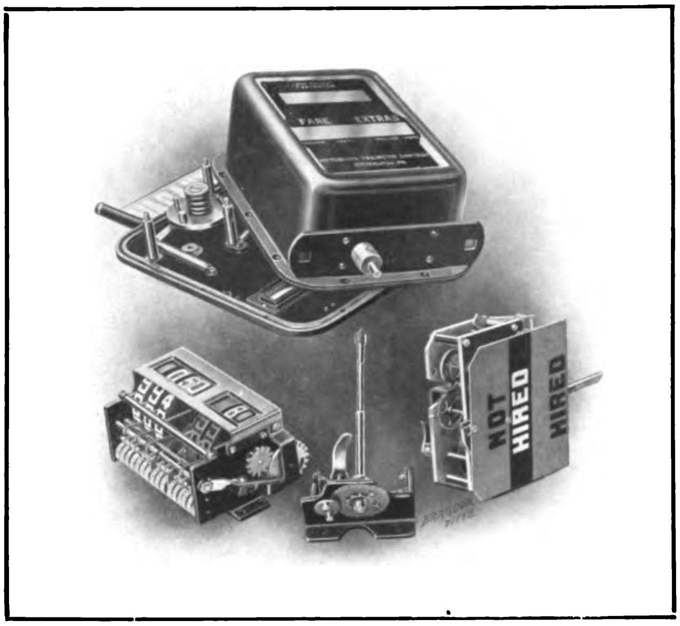
The Jones and Popp instruments, both made by the American Taximeter Company, 49th street and Seventh avenue, New York City, the former of American design and the latter of French origin, perform similar functions. They are fitted with "not registering" features, which permit of disconnecting further registration without disturbing the amount of fare then indicated. Accompanying illustrations set forth the front of the instruments and are readily understood. The rear views show the owner's record for each, giving an accurate account of the cab's movements, including total miles, dead mileage, number of trips, amount of cash collected, number of extras recorded and the time the meter was used in the "not registering" position.

Another illustration presents the Pittsburg taximeter, made by the Pittsburg Taximeter Company, Pittsburg, Penn., disassembled, the better to indicate the internal mechanism. It should be stated that the maker claims for this instrument that it has fewer parts than others, and that every part is interchangeable. A Yale lock protects the controlling device against the possibility of back reading.

It will be of interest to add that most taximeter companies rent but do not sell their instruments. The contract with the International Taxameter Company, for instance, covers one year, and makes provision for keeping the instruments in working order. The Pittsburg Taximeter Company sells its product outright,



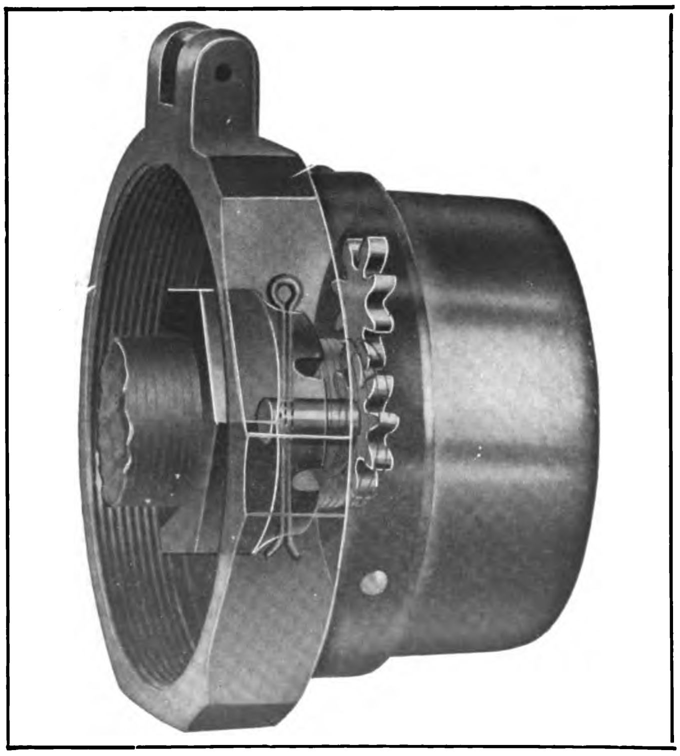
Front and Rear Views of Popp Taximeter, Presenting Information Available to Owner.



Pittsburg Taximeter Disassembled to Show Interior Components.

and it is guaranteed for one year. Inasmuch as the driving mechanism is reduced by gearing at the point where it enters the taximeter, the company claims that the instrument revolves very slowly and the wear is very slight, so that it should last indefinitely.

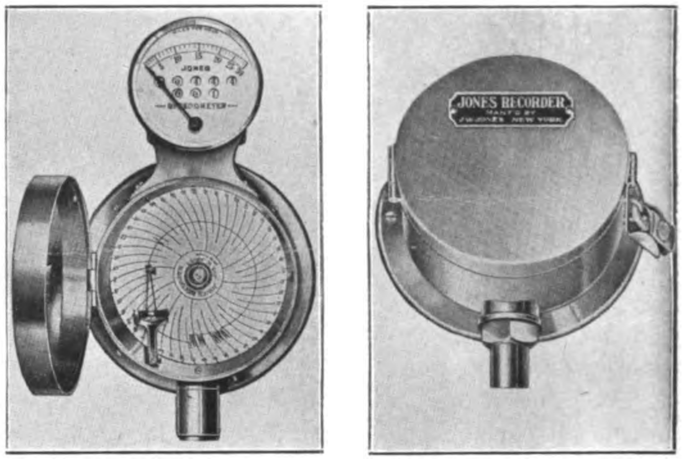
But taximeters were designed for use on taxicabs, and while they present features which are valuable in solving the peculiar problems of that business, their main purpose is different than those strictly required by the ordinary commercial vehicle. It may not be too much to suggest that the need for them and their method of accomplishing what is desired has resulted in incorporating some of their features in other recording devices which are now on the market.



Shadow View of Veeder Hub Odometer, Indicating Method of Operation.

And it may be added that even an instrument so complete as the taximeter has not entirely solved all of the problems of the taxicab owner, for a number of concerns are utilizing the Veeder hub odometer, for instance. The Fisk Rubber Company has installed it on several hundred cabs for which it supplies tires on a mileage basis, an indication of the value of this type of recorder.

The Veeder is made by the Veeder Manufacturng Company, Hartford, Conn., and comprises a small spur gear which meshes with a larger gear and suitable mechanism inside a cap which fits over the hub. No matter whether the car is driven forward or backward, the registering mechanism revolves in the same direction, and all of the distance travelled is recorded. The whole is securely sealed and the record cannot be changed in any manner without the owner's knowledge. This supplies accurate information as to the distance covered, and proves of value in checking up the totals indicated on the taximeter. It is equally as valuable for the truck owner in determining the mileage obtained from tires, etc.



Jones Recorder Opened and Closed, Presenting Type of Chart and Character of Record.

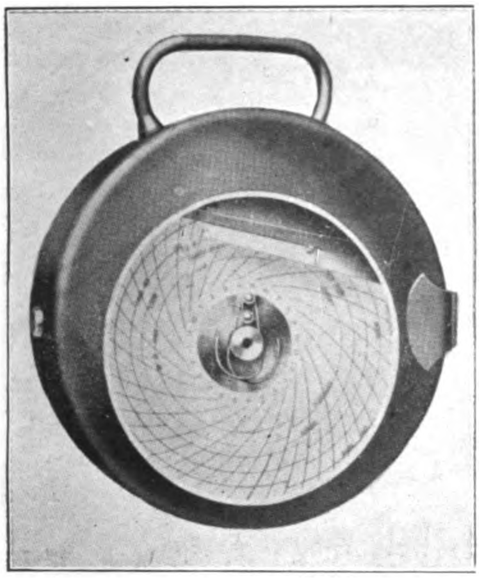
The Jones Speedometer Company, New York City, also manufactures a hub odometer along the same lines and for the same purposes. In addition it produces the Jones recorder, which may be used either with or without the speedometer attachment. The instrument is enclosed in a heavy brass case and may be attached to the dash or in any other convenient place on the car. It is connected by flexible shaft and gears to the front wheel, in exactly the same manner as the Jones speedometer. A marking stylus travels over a chart of sensitized paper, which cannot be tampered with, without unlocking the instrument, and which gives a permanent record of the vehicle's movement.

The Speedograph is now marketed by the American Taximeter Company. It is a combination device, including a speedometer, and when closed all parts are securely locked against anyone not in possession of the key. The lower portion contains the speedometer, which is connected by a train of gears with the actuating device at the top. The chart in this instance is in the form of a tape, on which a recording pencil

keeps accurate record of the vehicle's every movement.

Another form of tape record is made by Delivery Supervision Company, New York City, which recently took over the business of the International Delivery Supervision Company of that city. The tape is wound upon a drum, which is encased and connected with the road wheels of the vehicle by a flexible shaft. It is located on the dash, and the record is permanent in every respect.

The ServiS recorder, made by the Service Recorder Company, 2344 East 105th street, Cleveland, O., comprises a Seth Thomas eight-day clock movement and a brass disc, which is revolved once every 24 hours past a jewel pointed stylus, which registers travel and stop periods on a printed chart of sensitized paper, lying flat on the disc and travelling with it. The stylus, being attached to one end of a free swinging pendulum, marks a thin, clear line on the chart so long as the vehicle is quiet. But when the truck is in motion the pendulum is agitated to and fro, and the stylus marks a broad travel line about .25 inch wide.

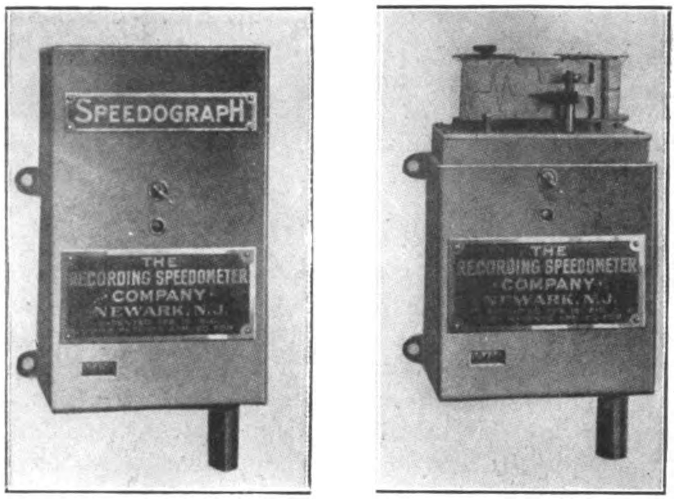


Front View of Travelog, Sealed and with Chart in Place Ready for Installation.

The Travelog is made by W. H. Brown, Rose building, Cleveland, O., and is similar in its application, but makes provision for a whole week's work instead of one day. The mechanism comprises an eight-day Howard clock movement, with actuating parts of cold rolled steel, enclosed in a pressed steel case and secured with a Yale lock. The two last named devices may be located at any point on the chassis, since they are actuated on the principle of vibration.

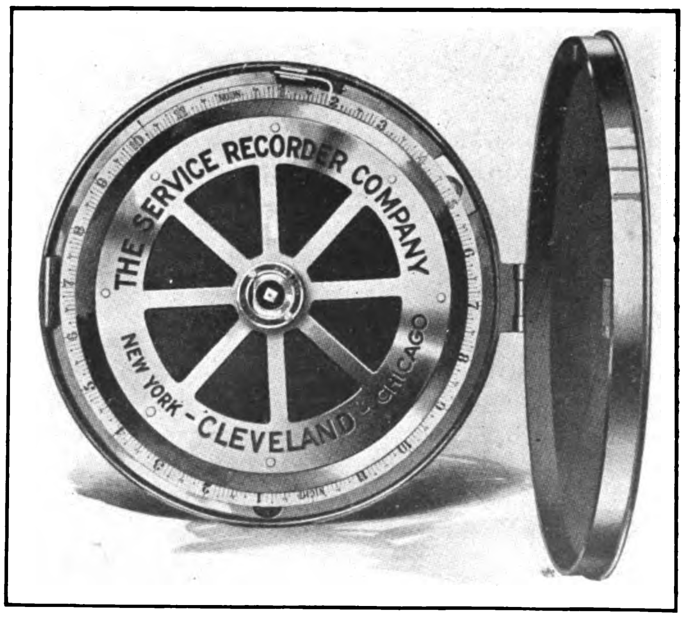
The charts of the Jones, Speedograph, ServiS, Travelog and the Delivery Supervision Company's device present an accurate account of the vehicle all of the time. They will tell when the car left the garage or any given point, how long it took to reach a given destination and how fast it was driven on the way, how long it was detained in loading or unloading, whether or not the driver loitered on the way, whether he put on undue speed at any time in order to make up for avoidable delays.

Most of these recording devices are sold outright, but the product of the Delivery Supervision Company is rented, it being in effect a part of the concern's system of furnishing general supervision over the haulage proposition placed in its charge. In addition to the charts, or tapes, upon which the record is made by the instrument, this system includes a series of uniform reports covering the analysis of these records. It is maintained by the company that the chief importance of a recording device of this character lies in the information afforded, which becomes of value only when it is presented uniformly and systematically. When the analysis is made by a disinterested third party it will be conceded that there can be no possibility for questioning the evidence submitted.



Speedograph Opened and Closed, Showing Pencil Making Record on Tape.

Little attempt has been made herein to do more than suggest the ways in which the various devices and systems may be applied. That they are accomplishing the object for which they were designed is evident from the increasing uses to which they are being put. They offer the means for solving almost any problem with reference to the economical and efficient operation of the vehicle, and are possible of being made to conform to the varied needs of the man who is seeking reliable information of this character.



ServiS Recorder, with Chart in Position for Recording.

POSTAL COLLECTIONS WITH MOTORCYCLE.

THE work of a motorcycle van used for collecting mail at Springfield, Mass., is being observed with extreme care by Postmaster L. C. Hyde of that city, who is to make reports to the Postoffice Department of the national government, for much importance is attached to the service that can be obtained with the machine. The outfit was built by the Hendee Manufacturing Company, with a view of the particular requirements for mail collection, and while it may be possible to improve the body or box for carrying the load, the machine itself is a standardized seven horsepower twin-cylinder motorcycle, fitted with the auxiliaries furnished with all fully equipped vehicles.

The motorcycle has been equipped with a regular 1913 Indian sidecar chassis, but instead of the usual seat and footboard a metal compartment or enclosed body has been installed, which is 40 inches length, 19 inches width and 24 inches height, and which is estimated to have a carrying capacity of 300 pounds. The

Indian Motorcycle Van Now Used for Night Mail Collection at Springfield, Mass.

body is substantially built and the top or cover is slightly curved to afford drainage in the event of rain. There are three openings into the body, one of which is in the top at the rear, through which it is intended that the mail collected shall be deposited. A chute from this opening carries the mail forward by gravity so that it is received at the forward end and then through the motion of the van is carried back toward the rear of the compartment. Under the chute is a small compartment for carrying tools and parts that might be needed.

At the bottom of the forward end is a third opening, and the cover or door may be dropped to unload. Guides at either side of the cover prevent the mail being scattered, and the mouth of a mail pouch may be placed about the door, which then becomes a spout or chute through which the mail may be quickly pushed into the bag. It is used for night collections, taking the place of one horse wagon in what is known as the "Hill district," and is operated by a carrier who was given opportunity to become reasonably experienced before work was begun. The carrier leaves the postoffice at 9:45 in the evening and returns at 12:40, being allowed practically three hours for the trip. Four horse wagons were used before the motorcycle was placed in service, but it is believed that its speed will permit the increase of the size of the collection districts and the use of three machines.

The expectation is that the carrier will be able to drive close enough to the mail boxes located on the edge of the sidewalks to collect from them without leaving his saddle, and the opening of the body is located so that he may deposit the mail conveniently and without loss of time. As the engine may be left running while the machine is stopped there is no delay in starting. The van was ordered by the Postoffice Department for the experiment and it was designed for the work. It is claimed by the manufacturer that the power is sufficient to make the collection round under any weather condition, and if this is realized it is extremely probable that machines will be ordered, not only for this service, but for the collection and delivery of parcels post. The motorcycle will be practically on trial during the winter and if it measures up to expectations it is probable that others will be placed in service, not only in Springfield, but in many other cities throughout the country. For this reason the trial is of particular significance to the manufacturer and to the postal authorities.

TRACTOR REPLACES HORSES.

Maine Agricultural Experiment Station Finds It Almost Indispensable for Farm Work.

An automobile plow and tractor which was put in service at Highmoor farm, the Maine agricultural experiment station, during the last summer, has proved the worth of such vehicles in farm work. The tractor was purchased of the Hackney Manufacturing Company, St. Paul, Minn., and all kinds of plowing was done during the season. In the orchards, work that formerly took horses five and six days to perform, was done in two days by the tractor.

Two sets of harrows are used at once on the machine, while one set could not be pulled by a pair of horses. Stone was carted from fields, the loads being such that four horses could barely move them. In a nine-hour day the gasoline consumption varied from 10 to 14 gallons and from six to eight quarts of lubricating oil were required. With the machine more work was done than with eight horses. By changing the drivers the tractor could work from 15 to 18 hours a day and in a 14-hour day it performed more work than 12 or 15 horses. The Maine officials will use the tractor next year as it been found almost indispensable in the work of the experiment station.

ELECTRIC VEHICLE HAULAGE ECONOMIES.

Facilities That Afford the Greatest Possibilities of Motor Delivery Service Developed by F. A. Poth & Sons, Inc., Philadelphia's Largest Brewery--An Ideal Combination, Sufficient for All Probable Expansion.

By William W. Scott.

THE possibilities for economizing highway haulage are generally limited by conditions over which the business man has no control. No organization will prevent retardation of traffic from congestion of the streets or the roughness of their surfacings. Unless there is a very cogent reason no change can be expected that will facilitate the handling of the loads at the point of delivery. While it is certain enough that any one of these factors is of sufficient importance to receive the serious consideration of business men individually and collectively, and there is no question that each will eventually be given the attention it deserves, it is very apparent that betterment can only be accomplished by regulation and co-operation.

Part of the Combined Loading Shed and Garage of the Brewery of Frederick Poth & Sons, Inc., Philadelphia, Penn., Showing the Platform and Spur Track at the Right; at the Extreme Left, Beyond the Line of Posts, Is Storage Space for a Full Row of Vehicles.

Because of these limitations there is greater reason why nothing that will yield economy of highway transportation shall be neglected. The factors that can be considered with practical certainty of economy are the increased speed and the greater load capacity of the motor vehicle, and the actual handling of the freights carried. While any one of these may be reasonably productive when a common sense method is adapted, it is obvious enough that the most economical system will be that which will realize the possibilities of all.

It is not practical or possible to develop haulage economy without the exact knowledge that comes from accounting. It is necessary to know every detail of work accomplished and item of expense to make even intelligent comparison of the value of two methods of transportation, and it is only by possessing and utilizing this information that high efficiency and economies can be insured.

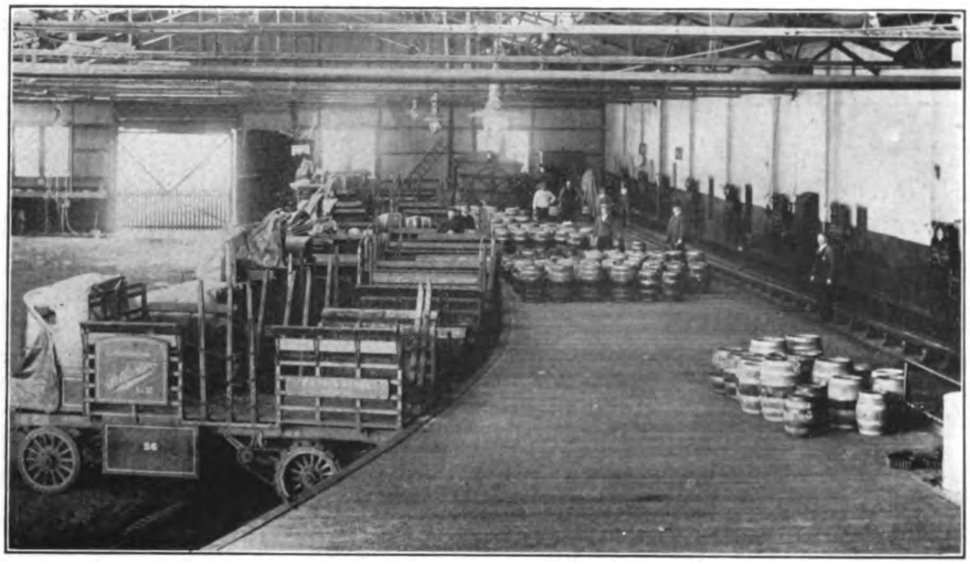
In some instances practical business men have regarded the facilities for loading and unloading of quite as much importance as the vehicles and the system by which they were operated. While this is undoubtedly a view that is entirely justified, it is a fact that the use of motor vehicles is, with most business concerns, still looked upon as an experiment, and there is not the confidence obtaining that would impel the expenditure of large amounts to make changes in facilities.

It can be safely stated that wherever facts have been established by careful accounting, and there is positive knowledge of the economies, expenditures have been made that may seem very large, and yet are considered to be in the nature of conservative investments. Probably the best examples of development of economic transportation are those of concerns having experience extending over considerable periods of time. Not only this, there has been a desire to adapt a service to meet any condition and to ascertain the possibilities of any idea that seemingly had merit. Generally speaking, the purpose has been to improve

the service and to lessen the expense, but not to sacrifice in any way through unwarranted expenditure.

While it cannot be said that any one instance is a rule by which to measure the general application of a theory or principle, it will not be denied that when a service and facilities have been determined with extreme care it may be depended upon as having qualities that command the attention of business men.

The experience of Frederick Poth & Sons, Philadelphia, Penn., which is the largest brewing firm in that city, with motor vehicle delivery service, is of unusual interest in that this concern has eliminated all save 14 horses from its delivery and replaced them with trucks and wagons, and it has provided what are probably the best facilities in the country to secure from its machines the greatest measure of economy. The transition was not accomplished in a short period of time. In fact it has extended over a term of 10 years, and every change was determined only after careful study and observation that would conclusively establish its economic value to the company.



The Loading Platform and the Conveyor by Which the Kegs Are Carried to the Waiting Trucks, Where 26 Machines Can Be Loaded at the Same Time.

More than 10 years ago the firm purchased a five-ton electric Vehicle Equipment truck, and began its operation. At that time the brewery stables contained about 175 horses. The production has always been sold in kegs and barrels and the customers have been principally in the city, although there is a small part that is shipped to patrons within a radius of perhaps 30 miles. While the business has increased to some extent during the decade there has been no large development because of the absence of competition such as may be found in other localities. That is, there has been a reasonable and satisfactory growth, but it has not been a result from a campaign directed toward other brewery products.

Today the company has in its service 32 electric machines, of which 30 are General Vehicle wagons and trucks and two are products of the Commercial Truck Company of America, a Philadelphia concern, and two five-ton gasoline trucks. Three more electric trucks have been ordered and these will be delivered in a short time. There are now in the stables of the company 14 horses, two of which are used for driving purposes and the others for delivery, but when the three trucks ordered are received it is expected that all of the horses will be eliminated from the service. It will be seen that the motor wagons and trucks have each replaced an average of about five horses, though the vehicles range from one ton to five tons capacity. The sizes are as follows:

One-ton, electric	5
Two-ton, electric	4
Three-ton, electric	8
Five-ton, electric	15
Five-ton, gasoline	2
Total	34

Of the electric machines one three-ton and one two-ton are Commercial vehicles, and the remainder were built by the Vehicle Equipment and the General Vehicle companies. One of the gasoline trucks, a Pierce-Arrow, was delivered last April, and the other, delivered in May, is a Mack. These are the only explosive engine motor trucks that the company has owned.

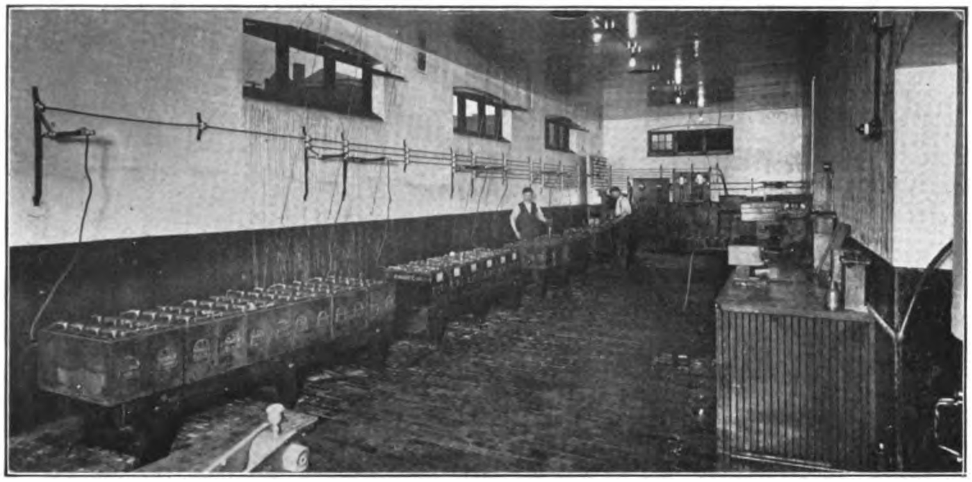
The plant of the company is on either side of Jefferson street, between 31st and 32nd streets, and on the north side is the storehouse, the stable and the loading shed and garage. When the storehouse was built it was with no expectation that the horses would be replaced by motors. The ground rises rapidly north of Jefferson street and the level is perhaps 15 feet above the street at the rear of the storehouse. The Jefferson street frontage of the building is unbroken, but entering through a large gate one reaches a court of considerable size with the storehouse and the original loading platform at the right, and at the left a building with the lower portion designed for a garage or wagon shelter, and the upper or second story intended for use and equipped as a stable.

The arrangement of the buildings was extremely advantageous. The centre of the court is open and the ground is paved and well drained. The purpose was to have the wagons and trucks within the court, with access to the stable by a runway. This construction was with a view of sheltering the men and animals when loading and unloading, as well as to making it convenient to hitch and unhitch the teams. There was another run from the stable to 32nd street. As the loading platform was limited in size and it was not possible to have all of the teams in the courtyard at one time the loading could not be carried on simultaneously and it was necessary to relay the trucks

into the court. As all of the vehicles did not return at the same time they could be unloaded with practically no inconvenience or delay.

When the first electric truck was placed in service this was kept in the garage off the court. As this section of the building facing the court was open, but could be closed by curtain doors, it was gradually given over to the machines until its capacity of 16 was reached. For the purposes the garage was all that could be desired, there being sufficient light, and a large canopy in front extending the entire length, and it was well heated in winter. The battery room was located at one end of the garage. When the first electric truck was installed and it was found to be a satisfactory vehicle the company planned its garage service. It produced its own current and with the machine facilities of its own shop and the services of its machinists always available, it was believed that motor vehicles could be used to excellent advantage.

The first experience of the company was, like that of many other concerns that have used motor trucks for a long period, not economical or satisfactory, which was due largely to the inability to obtain men competent to maintain the machines and the batteries. In 1904, however, A. Stevenson, who had had a thorough training as a machinist and considerable experience with automobile construction and repairing, was engaged as garage manager, and from that time the company has been exceedingly well served. At that time the number of wagons and trucks in service was few as compared with the present equipment.


Interior of the Battery Room of Poth's Brewery Garage, Equipped to Charge Four Batteries at a Time—An Ideal Installation.

In experimenting with the electric machines they were worked consistently on routes that had been served with horses and the character and volume of the service was carefully noted. There was no desire to accept anything as a fact until it was demonstrated by results and this applied to every detail of cost of operation, maintenance and upkeep. The expense of delivery was figured on the basis of a barrel, which permitted absolutely accurate comparison for both animal and motor vehicles. But cognizance was given to the fact that there is a greater average cost with a small number of electric machines than with a large installation, and a reasonable allowance was made.

The routes served by the regular delivery service of the company are decided by Frederick Poth, and as his supervision of this work has been for a number of years, and has included both animal and motor vehicles, his judgment has largely determined the form of equipment. Mr. Poth has been a motorist for years and this experience has been of decidedly practical benefit. The possibilities of animals and electric machines have been determined through service for as long a period as was necessary to reach absolutely dependable facts, with reference to each specific instance. Mr. Poth made comparisons of service under all conditions of operation, and his observation may be said to be constant. He personally observed the results from trials and experiments and has first hand knowledge of such influences as may have bearing upon efficiency.

Philadelphia as a city covers a large area and the topography may be regarded as moderate so far as gradients are concerned. The city is 14 miles in length and seven in width and there are about 1500 miles of paved streets and 500 miles of what may be regarded as road in the suburban sections. There is a ridge between the Delaware and Schuylkill rivers, and this must be ascended or descended. Arch and Market streets, two of the main thoroughfares, have paving that is ideally smooth, but the other paved streets by no means compare with them. While the surfaces may be considered good when contrasted with the streets of New York or Chicago, both of which are notoriously poor, they suffer by comparison with the highways of many other cities, but principally from their roughness, which is destructive of animals and vehicles alike.

Outside of the city are numerous suburbs, and to these delivery is made. The route that serves Chester and Bristol covers from 48 to 53 miles, and the road to Bristol is very hilly. This is particularly true of that part of the highway that reaches Busselton. The direct Chester road may be regarded as fair. The Clifton Heights highway is of much the same character as that to Busselton. Chester and Bristol are the farthest points that are served by the regular delivery.

Before the number of electric wagons and trucks in service had reached the capacity of the garage that has been described it was realized that to secure the greatest economy of service it would be necessary to make many changes because the machines must be sheltered. The loading platform was found to be too small and the courtyard could not be advantageously

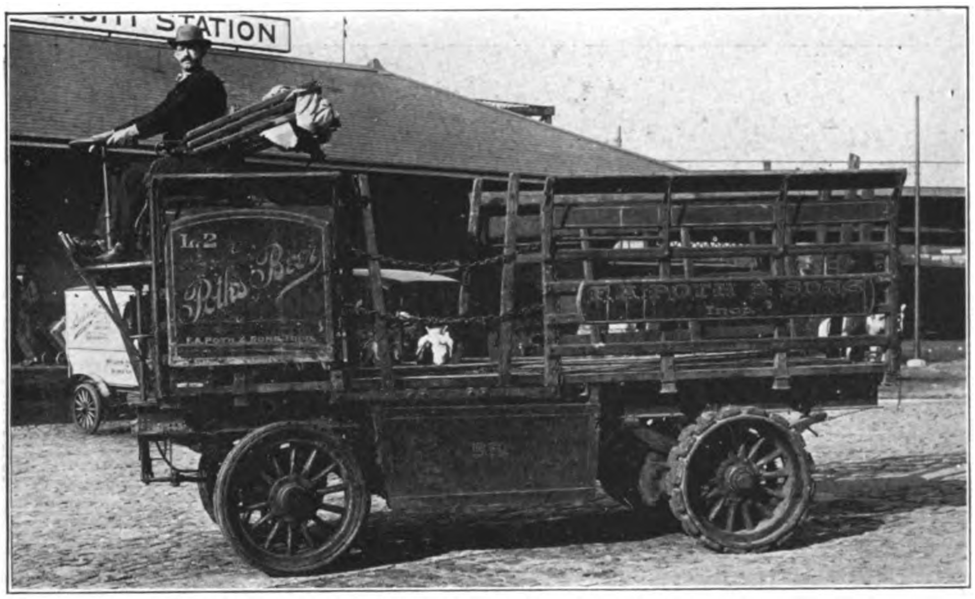
used because of the congestion of vehicles when loading and unloading. To secure the fullest service of the motor vehicles they must be utilized as constantly as possible during the working hours of the day. While there was every reason to believe that horses would eventually be replaced by the machines, the time when this would be realized could not be determined with any degree of certainty.

To make provision for a considerable number of years and to insure facilities that would be adequate for the business it was decided to build a loading shed on the higher level back of the storehouse with a platform extending the entire length of the property between 31st and 32nd streets. This was planned so that the kegs and barrels could be brought from the storehouse by elevators and carried along the platform by conveyors, and to minimize the handling and eliminate the hauling in freight shipments a spur track from the Pennsylvania railroad was included. The platform was built in 1908 and after this was erected it was decided to cover it with a trussed roof of the monitor type and to have large entrances at either end that could be closed with a gate, the whole forming an enclosure that would shelter the entire wagon and truck equipment.

The structure as completed is very substantial, being of brick and steel, with but a single line of posts along the north side. The loading platform was intended to allow 26 vehicles to back to it, and the spur track is of a length that will take eight freight cars under the roof at one time. The surface of the ground is paved to permit drainage and the track is filled with plank so that the vehicles may be handled without difficulty at the platform. At that time there was a runway from the horse stable to 32nd street, and this made it possible to bring the animals to the shed as quickly as to the lower courtyard.

The number of electric vehicles was gradually increased and the horses decreased, and as the capacity of the garage off the lower courtyard was exceeded the machines were housed in the loading shed, and this led to the installation of charging apparatus. Then followed the determination to utilize the loading shed as a garage and to equip it with whatever was necessary to meet the requirements. This was followed by other changes, some of which have but recently been completed, and today the brewery has in this combination facilities for handling its delivery service that are probably not equalled in the world.

The loading shed is sufficiently large to shelter 100 wagons and trucks, and with an exit at either end of the building it is possible to handle the machines with ease and celerity. The vehicles now in use can be arranged in two rows, one at either side, giving the entire floor area between them for whatever purpose may be necessary. In installing the equipment Manager Stevenson departed from the usual custom of a multiple charging panel and located 32 single panels, this necessitating the assignment of a permanent location to each vehicle. On the loading platform side the panels are placed close to the wall of the storehouse, one directly behind each station of the machine it is intended for. On this side are located the first 16 machines to go out in the morning and when they are brought in at night and backed to the platform they are not only ready for charging, but are ready for loading. The charging leads from the panels are carried across the platform. On the opposite side of the loading shed are located the other 16 panels, and these are placed with reference to the machines they are to be used with. When these are ready for loading they are simply turned and backed to the platform. It will be practical to supplement these panels as desired.



The Veteran of the Poth Trucks, a Vehicle Equipment Machine, Bearing the Maker's Number of 362, Fitted with Special Brewery Body.

The value of the single panel is stated by Manager Stevenson to be in the saving of time in going to and from a machine to a single board to make the necessary readings of the indicators, as well as giving the man directing the charging certain information of the condition of the battery, and insuring that each will receive the attention desirable or necessary. Not only this, where exact battery data are sought this individual supervision has been productive of observation that is distinctly valuable. Several months ago the battery room was removed from the old location to an addition built on the loading shed, and this is of sufficient size to perform any work that may be desired. Specially arranged and equipped for battery work the facilities may be regarded as ideal. There is a charging panel where four batteries may be charged at once,

and this permits work of restoration or forming that is at present considerably in excess of the requirements. The room is paved with wood blocks and the floor may be flushed to eliminate the acid and electrolyte that may be spilled in the work.

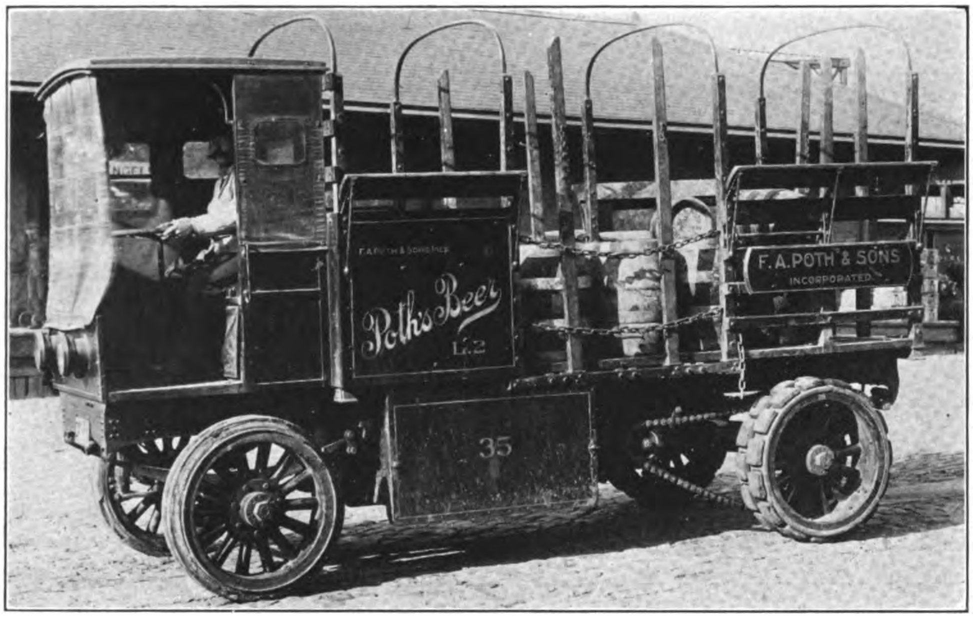
The greater part of the stable on the second floor of the building that was formerly used as a garage has been converted into a machine shop, and a concrete run built so that the machines may be driven from the loading shed into it. As it is arranged seven vehicles may be placed in a line in the centre of the shop with abundant room to work at either side. Here has been installed such machine tools as are necessary, although the heavier work is done in the main shop. This entrance is directly across the loading shed from the battery room.

The loading shed has been more thoroughly enclosed to maintain a sufficient degree of warmth, the roof ventilators have been adapted that they may be closed during the winter, the entrances provided with sliding doors, and a system of piping has been placed and a boiler installed so that the temperature may be kept to a degree that will not affect the efficiency of the batteries or lessen the capacity of the men. At the north side of the loading shed a channel has been made in the floor in which has been laid three large steam pipes. At regular intervals are sections covered with grating and with plank. The gratings are located as to be directly beneath the battery cradles of the machines kept on this side, and in cold weather the pipes are heated. Canvas curtains that reach the floor are hooked on the sides and ends of the battery boxes, and these confine the heat about them and maintain the temperature at such a degree that the capacity of the machines is not lessened. It is possible to regulate the heat to meet practically every climatic condition that could be experienced. The shed is lighted with six big arc lamps.

The loading capacity of the platform is 26 wagons or trucks, and to serve these there are two conveyors from the storehouse located nearest to the 32nd street end. The one of these carries the kegs or barrels the length of the platform, and the other serves the end only. The loading is begun at 6:30 in the summer and 7 o'clock in the winter, and a half-hour before the drivers report the conveyors are started and the platform is filled when they arrive. The shipping clerk's office is located on the platform and here the orders are received and the requisitions for vehicles are made out. No machine is ever sent out overloaded. Should the load be excessive the responsibility would be upon the shipping clerk, who directs the loading in the absence of Manager Stevenson. If Manager Stevenson is present he usually passes upon the requisitions. He decides what vehicle shall be sent out in the event of a load being larger than the machine usually used by a driver will carry. If the order for a route is so large that it will overload the wagon usually sent out on it another is assigned. If the load is less than what is ordinarily carried a change may be made. The driver is kept on the work regularly because he can probably better handle it than one less familiar with his customers, but he may have different machines whenever in the judgment of the manager it is best to make the change.

With this system of supervising the loading there is no uncertainty about the weights carried and it is possible to have the vehicle capacity where it will be serviceable. The only exception to this rule are the gasoline machines, which are operated regularly on the long suburban routes. The advantage of this method is that no matter what the variation of orders may be the fullest capacity of the entire equipment may be utilized, and there can be no question of the value of placing the responsibility entirely on the man who knows best what each machine can do. After the first loads have been sent out supplementary orders are received and these are delivered with such wagons or trucks as may be available, these being selected for the work with reference to their battery capacity. This is an insurance against loss of time through battery exhaustion, because the batteries are tested when the machines are brought back to the garage and their condition so far as power is concerned is definitely known.

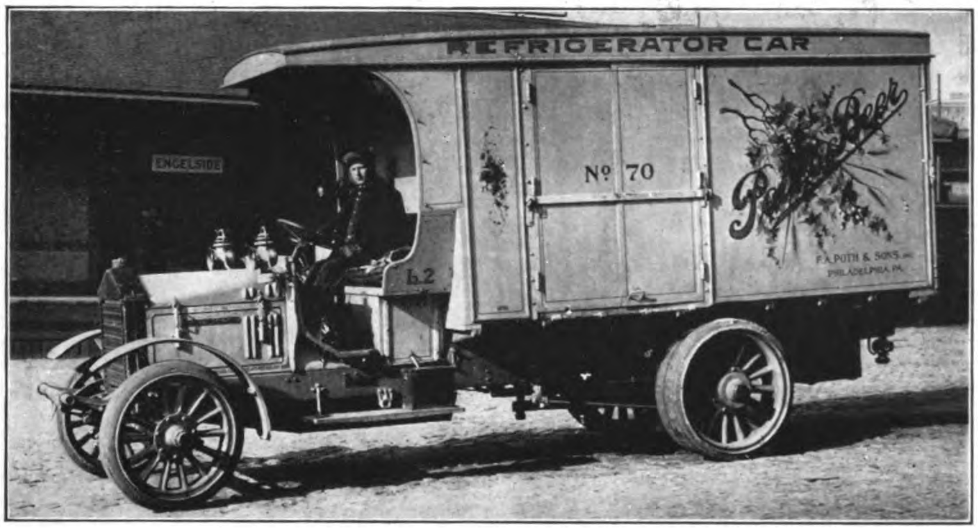
The loading is always done to a system, and this requires the drivers to assist the drivers of the first three trucks to be started, and with these out of the



The Latest Addition to the Poth Service, a General Vehicle Truck with an Unusual Body Equipment to Protect the Load and Driver.

way the men individually load the machines they drive. If more than one load is taken out the driver does his own loading. As the kegs are carried along the platform by the conveyor they are rolled off by the drivers, who select the number of each size they are to carry out. The kegs are then placed on end back of each machine and are ready for loading. When the trucks return with loads of empty barrels these may be carried into the lower courtyard, where they are unloaded and are washed and sterilized, or they may be unloaded at the loading platform, where a conveyor carries the kegs to the courtyard. In this courtyard the trucks are usually washed with a hose and cleaned from mud and dust. The equipment is always well kept and its appearance is a source of pride with the company.

One particularly interesting body installation is that on the Pierce-Arrow chassis, which is used on the Bristol route. This is an enclosed type that may be loaded at the rear or at either side. The doors are tight fitting and the entire body, roof, top and sides, is lined with thick sheet cork. The purpose of this insulating is to keep the beer cold on the long route during the heated periods. It is stated that it is possible to carry beer in this truck for several hours without a sufficient increase of temperature to affect it, the kegs being loaded from the storehouse at a degree not much above freezing. Prior to the building of this body the beer was protected with canopies and tarpaulins with not always satisfactory results.



Side and Rear Loading Enclosed Refrigerator Body, Lined with Cork to Maintain an Even Temperature for Loads Carried Long Distances on a Pierce-Arrow Chassis.

The drivers finish their work for the day from 4:30 on and by 7 the trucks are practically all in the garage. After they have been washed they are backed to their respective stations and the charging is begun at once. The company produces its own current and this is supplied at from 30 to 35 amperes. The main line voltage is approximately 120, but with the series of batteries connected this will be reduced to about 109 by the resistance. The charging is usually completed about 2, and in cold weather the batteries are again connected for a short time in the morning before loading to increase the temperature and establish the capacity as near normal as is possible. In the "boosting" the voltage is increased to about 130, and the amperage is approximately 20. Saturday nights the batteries are charged to the line voltage at 25 amperes, and Sunday nights they are again connected and charged at low voltage at from 18 to 20 amperes until morning, this giving an overcharge that is desirable to establish certainty of capacity and neutralize sulphation.

The batteries are carefully maintained. When new they are installed in the machines from which the largest mileage is expected and as the capacity is reduced with use they are changed to vehicles from which less work is required, and this process is repeated until the battery is no longer serviceable. As a rule all of the batteries used are built, the material being purchased and used as needed. The rebuilding and maintenance work is considerable and the attention is systematic. Each battery is equalized once a month and it is customery to cut out a cell at that time and ascertain the condition. If there is defect or loss of capacity the cause is located and the restoration made.

The garage day organization under Manager Stevenson consists of an electrician, two machinists and a battery man and a helper, but he is also responsible for considerable other work outside of the garage and the entire time of the electrician and the machinists is not given over to the wagons and trucks. The night force consists of a mechanic and a helper who care for the machines, the mechanic supervising the charging and the helper oiling and greasing them. The facilities for repairing and maintaining the machines are all that 10 years' practical experience can suggest and by carrying a comparatively small stock of spare parts practically every exigency is provided for.

The records kept include the mileage of each vehicle and the wheels and tires with which it is equipped. The wheels are numbered and they are followed if changed from one machine to the other. The tire record shows the number of the wheel on which it is used and the mileage can be established by the daily total taken for each machine. The record of each battery is kept by miles, so that it is possible to learn the work performed up to a given time. Each machine is equipped with a service recorder, which shows the number of miles driven, the speed at any time, the number of stops and the time of each, and these records are filed after the data have been supplied with reference to tires and batteries. The average work is approximately 35 miles daily for the five-ton machines and 41 for the three-ton trucks, which is

practically the maximum service expected from them. The battery records show all of the work performed upon them so long as they are in use and the salvage from old material returned to the manufacturer. The labor of the electrician and the machinists is specified and the requisitions for stock and material of any kind indicates the cost of maintenance aside from the labor. The charging record shows the current consumption, which is charged at the cost at which it is produced. In the accounting the overhead charges are established and it is possible to determine with great accuracy the expense of operating the service and the delivery on the basis of a barrel. In the long hauls the gasoline service is kept separately so far as service records are concerned, although it was once included with the other machines when the electric trucks were used and from 48 to 53 miles were made daily by two machines which were equipped with two batteries each connected in multiple. There is a gasoline storage system of the hydraulic type in the garage and the record of fuel and lubricant for the gasoline trucks is also separated from the electric.

The streets of the old section of Philadelphia are narrow and traffic in them is often congested with considerable delays at times, and as delivery from the vehicles cannot be expedited, there are limitations to the economy of time that cannot be changed with any form of transportation. In the development of its service the management of the brewery has made every provision for improvement that experience could dictate, and the value of the motor truck as compared with animals is best shown by the practical elimination of horses.

As to the measure of economy that is obtained through the use of motor trucks and wagons, if one considers the expense since the first machine was installed and on this basis makes his estimate it is probable there will be no saving as compared with horses, but if the work that is now accomplished is placed against animal service it is certain that the cost would be decidedly smaller. And it is well to point out that with the increase in the number of machines the average cost of operation is lessened.

NEW MOTOR TRUCK WHEEL.

Boston Inventor Seeks Factory Location in Fitchburg, Planning Production in Near Future.

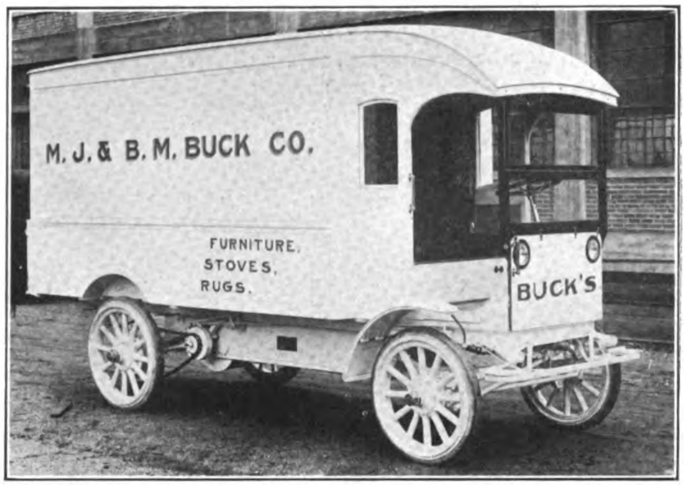
Joseph H. Symonds of Boston has invented a new style wheel for commercial motor vehicles and at a recent demonstration of the device it was thought by business men of Fitchburg, Mass., to be practical. A truck or delivery wagon will be manufactured having as its chief recommendation the wheel designed by Mr. Symonds, who has been in touch with R. D. Redfern, industrial secretary of the Fitchburg board of trade, with a view to locating the factory in that city.

The old Becker machine shop at Water and Newton streets was recently inspected by Mr. Symonds and Mr. Redfern and it was agreed that it would make an excellent place for the manufacture of motor vehicles. This site will be chosen if it is decided to manufacture the machines in Fitchburg. It is proposed to interest local capital in forming a company and it is stated that all of the patents are in such shape that the work could be started within a very short time. W. F. Magill of Boston, who is associated with Mr. Symonds in his business, says that already a large number of orders have been received.

AN IMMACULATE FURNITURE WAGON.

Details of Detroit Electric Vehicle Placed in Service with Buck Company in Lansing, Mich.

An extremely attractive and pleasing vehicle is the 3000-pound Detroit electric chassis that has been placed in the service of the M. J. & B. M. Buck Company, furniture dealer, at Lansing, Mich. The chassis is the standard type, equipped with a 60-cell Edison



Detroit 3000-Pound Electric Chassis, Fitted with Special Enclosed Body for a Lansing, Mich., Furniture Dealer.

battery, and on this has been installed a covered body that is specially designed for carrying loads of large bulk. The construction is extremely wide and semicircular recesses have been made in the floor and sides above the rear wheels to provide for the body movement when the vehicle is loaded.

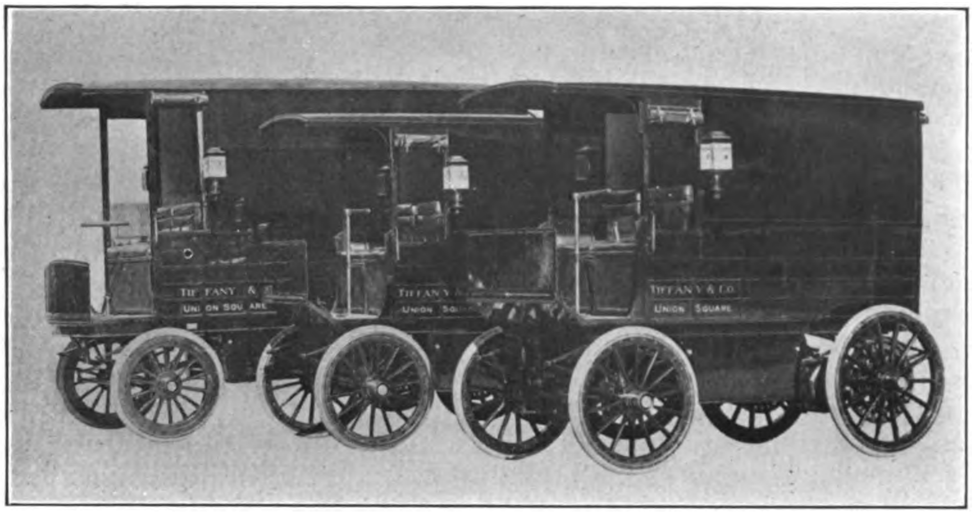
Forward of the body is the cab, which is the width of the chassis frame, with side panels the full depth of the seat. In these panels are windows, which afford an excellent view at either side. The roof of the body covers the cab and curves sharply downward to the height of the top of the windshield installed upon the dash, the lines of the sides and front being especially harmonious. The protection for the driver is unusually good, and the machine may be said to be equally well adapted for extremes of temperature and storms. The wagon is one of two or three that have been fitted with a panel body. The design is enhanced by being finished in egg-shell white, with a dainty outline of color and attractive lettering.

ELECTRIC VEHICLE PRACTISE.

Sound Engineering and Experience with Service Conditions Develop Capacity and Endurance of Machines---Battery Improvement a Large Factor for Increased Economy---Possible Sources of Power.

By William W. Scott.

TAKING up American productions in practically their order of appearance it will be seen that the Riker and the Electric Vehicle companies have ceased to exist, and that the Riker principle of double-motor propulsion was adopted by the Electric Vehicle Company, at least on its heavy machines. The use of two motors simplified the rear construction so far as it eliminated the compensating gear, but it was not believed to be as economical of current as the single motor, and complicated the power wiring. However, both Riker and Electric Vehicle machines are now in use and in some instances do exceedingly important service, with a reliability after 10 years' operation that is decidedly surprising. From every aspect the construction has been satisfactory, and it can be said that had the engineers been as confident of the possibilities with these machines it is doubtful they would have turned to any other. In fact it may be said that the endurance of vehicles of this design, well maintained and systematically cared for, is not yet known. So far as the conservation of power is concerned it should be known that in many instances these machines were built without the roller and ball bearings so generally used today, and in instances where such bearings have been supplied there is but comparatively little difference in the current consumed.



Three Vehicle Equipment Delivery Wagons, Delivered to Tiffany & Co, New York City, in 1901, That Have Been Used Daily Since That Time.

In the development of the electric delivery wagon there have been two distinct paths for endeavor, the one being the storage battery and the other with the vehicle construction. These have been pursued by different engineers, each more or less dependent upon the other. By this is meant that the vehicle designers have desired batteries of comparatively light weight and large capacity to minimize the load of the machine and to obtain the power that would increase the radius of movement. The need of reducing the losses through friction has been a problem for the designers only. They accomplished this in some of the early vehicles by the use of ball and roller bearings. Battery development was something with which the vehicle men had nothing to do other than to afford the benefit of their experience to the builders of batteries.

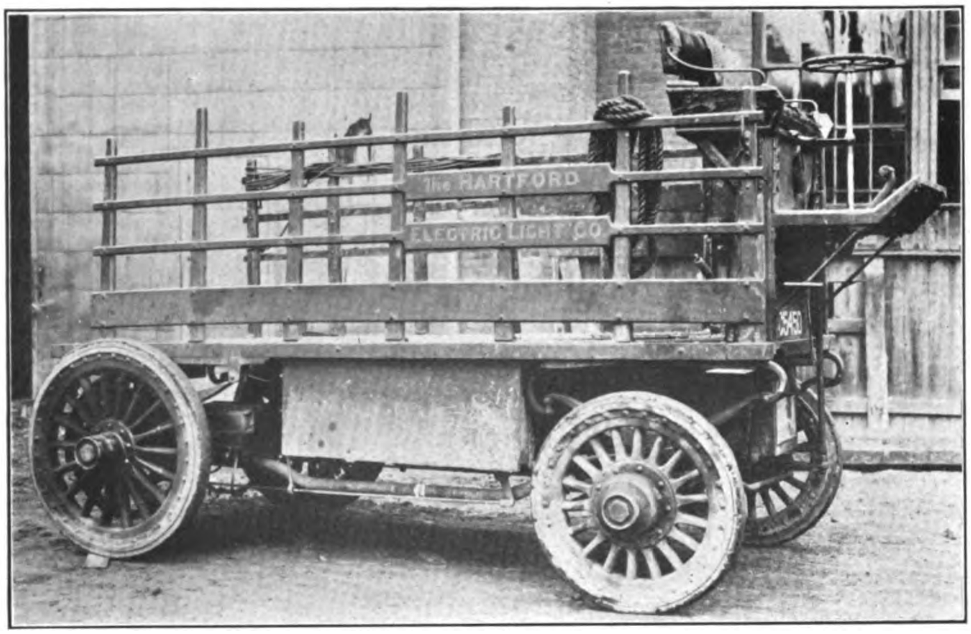
The basis of evolution may be found in the first foreign and American machines, and it will be understood that chain and direct drive were originally given attention. The first gasoline machines were generally chain driven and later on came the application of the shaft drive by Renault Freres in Frances. The success of this form of power transmission directed attention to its use. But there were other possibilities, which were experimented upon, and these included the following: The drive by a single reduction accomplished through a herringbone gearing; by a double reduction through a countershaft and single chains; by a single reduction through a shaft, countershaft and side chains; by a double reduction through single chain to jackshaft and side chains; by a shaft-driven worm gear; by a motor incorporated in the rear axle housing and driving through spur gearing to internal gears within the wheel rims; by two or four motors fixed to the axle spindles and driving by armature shaft pinions meshing with racks formed in the inner peripheries of the disc wheels; by two or four motors fixed or pivoted to the axles and driving through pinions to internal gears bolted to the wheel hubs. The last two methods of drive may be applied to either front or rear or all four wheels, and with the first of these a gasoline engine is sometimes installed to drive a generator whose function it is to keep the battery constantly charged.

All these transmission systems have proven to be efficient and satisfactory in practise. The shaft drive, however, is generally adopted for pleasure vehicles and the majority of the service wagons are driven by single motors with either chain or shaft connection with a countershaft and side chains. In some instances the drive from armature shaft to countershaft is by a silent chain, sometimes encased and operating in lubricant, and occasionally exposed. The differential with the double chain designs is incorporated with the jackshaft, and with the shaft, worm and herringbone gear driven machines it is a part of the rear axle. Where the direct shaft is the means for transmitting the power the rear axle is generally of the semi-floating type.

The preference is given by designers to the dead rear axle, the single motor and the double reduction by chains through jackshaft and sprockets, because it affords the most substantial construction, and there is not the disadvantage of carrying a large weight on the axle, which is subjected to very severe stresses when the vehicle is loaded. It should be remembered that simplicity is the one object sought by the builders of electric vehicles and with this a purpose to minimize frictional losses through the use of roller or annular ball bearings. It is assumed that the fewer the bearings the less the probable wear, and so far as this may be done the bearings are protected from abrasive substances.

It is extremely improbable that the designers of the service wagons built from 1898 to 1905 realized the excellence of their vehicles. It may be said of some of these machines that they were heavy, but the weight was largely due to the batteries and the ample margins of safety provided, for special metals were not so generally utilized as now, and the qualities were by no means as certain. Not only this, there was not the same certainty of endurance as now. By the use of high class material it is entirely practical to reduce weight and yet have greater strength as compared with the wagons built during the period stated. But some surprising illustrations of endurance are afforded by wagons that have been driven constantly over the extremely poor streets of New York. Several of the wagons operated by the New York Edison Company have been in service for 10 years, one has been used by Frederick Loeser & Co., for 11 years, one has been used by Stern Brothers for nine years, three of the fleet of Tiffany & Co., were delivered to that firm early in 1901, three of the machines owned by Arnold, Constable & Co., were delivered in 1903, one of the Riker wagons built for B. Altman & Co., in 1898, is regularly used, and one might go on indefinitely and specify vehicles that have been worked practically all the time. Probably one of the best examples of endurance is the Riker two-ton wagon that was paid for by the Hartford Electric Light Company in March, 1901, and which was delivered at least at that time. This wagon has been used constantly for all kinds of haulage and it is in such condition today that a new battery was recently bought for it, which indicates that the owner believes it will be serviceable for a couple of years more. The F. A. Poth & Sons Brewery at Philadelphia, Penn., is using daily a truck delivered 11 years ago, and so far as indications go it is just as reliable and does quite as good work as it ever did.

The work that these machines can do is larger than it was originally, because of the greater battery capacity, and compared with the results obtained with the vehicles of the latest design and construction the efficiency of the wagons is decidedly surprising. The mileage of the light types will average as high as 45, and generally more. There are in the New York Edison Company's service rebuilt Columbia surreys, that are now trimming wagons, that do 50 miles or more each night, and Stern Brothers' truck makes 40 miles each day in transfer work with a slight "boost." The veteran of Frederick Loeser & Co.'s delivery service averages a daily run of 32 miles in transfer work. None of these machines may be considered fast, but each is equal to the requirements.



Two-Ton Riker Wagon, Delivered to the Hartford Electric Light Company, Hartford, in March, 1901, That Has Been Used Constantly Since That Time and Is Still Considered Good for Several Years.

Regarding highway haulage from any point of view, while there may be a desire to haul loads of large capacity quickly it is a fact that the proportion of light wagons far exceeds those of the truck type. It can be said with certainty that this condition will

not be changed, no matter what the form of conveyance, although the ratio may differ from time to time. While the first delivery wagons were merely with closed bodies installed on pleasure carriage chassis, the possibilities of the electric vehicle for transportation were first practically developed by Andrew L. Riker, who, after his delivery of six small wagons to B. Altman & Co., built a five-ton truck for a wine importing firm in New York. This was at that time the largest machine ever produced and it was equal in capacity to the biggest standard vehicle of today.

If this machine served no other purpose it was an example for other builders of wagons, and it may be said with truth that the service it afforded was carefully observed and demonstrated the possibilities of motor vehicle transportation better than any other machine then available. There is no doubt that the actual value of that construction was not understood or realized, and yet the one surprising fact is that there has been so little change when the new productions are compared with the old.

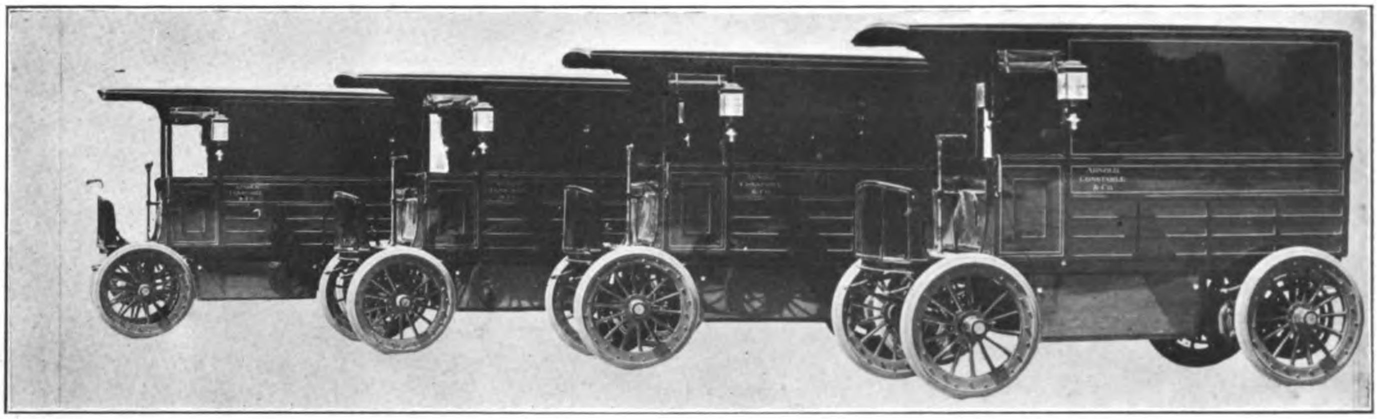
There should be no misunderstanding relative to the actual results obtained from electric vehicles. Originally installations were generally made because of the advertising value of a new or attractive form of delivery. Perhaps a few persons were satisfied that the electric wagon was practical and looked forward to the time when there would be development that would establish this fact. In experimentation, expense of operation and endurance were not seriously considered. Mechanical practicability was the one object sought. This result having been attained, actual service demonstrated that the electric machine was superior to the animal, but the cost of operation was large. There were many reasons for this.

The initial or purchase price was relatively larger than now. Batteries were costly, heavy and of comparatively small efficiency. Charging stations were very few and the cost of electric energy was large. The motor was believed to be a machine of uncertain quality and the battery was regarded as a mystery. Batteries then required a greater degree of attention than they do now and expert batterymen were not very numerous and in good demand.

The vehicles utilized for pleasure were generally looked upon as expensive creations, the toys for those who had resources and time to devote to them. With many they served to amuse for a time and passed from the one to the other. With the machines built for service purposes, however, they were measured by the cost of haulage by animals, and considering every expense they were not attractive propositions when economy was the main object sought. Besides the garaging problem was serious. The purchaser of a machine found it necessary to provide equipment that was regarded as expensive, operating conditions developed that necessitated expert attention, and, worst of all, there was apparently belief that an automobile vehicle could be neglected and still remain serviceable. Those who bought machines as business wagons demanded service, and it was necessary for the manufacturers to meet every conceivable problem and reasonably satisfy the owners.

The manufacturers of batteries developed their products decidedly. This progression has been comparatively rapid. Weight has been decreased and capacity increased, and durability has been secured to a surprising degree. In every respect improvement has been made. Not only this, but cost has been lessened. Instead of only the acid or lead battery, the Edison alkali, or nickel-iron battery has been developed and it is found to have qualities widely different, one of these being its extremely long life or period of service, and another is its durability. The improved batteries had the result of increasing the quality of service and the economy of the vehicles. Capacity and mileage were increased.

During the period from 1900 to 1910 it may be said that the electric vehicles were well tried and experimented. The number in use increased annually, but there were few concerns that produced them in considerable numbers, and only several that built service wagons exclusively. In the larger cities they were the most used because of the better facilities for charging and garaging. Some concerns having large requirements for haulage and delivery experimented with them. Some owners produced the current used. In New York and several other cities exclusive service wagon



Four Vehicle Equipment Delivery Wagons Installed in 1903 by Arnold, Constable & Co., New York City, and Operated Daily in Regular Service.

garages were established. There was no special encouragement given those who used the vehicles, other than the practical results obtained.

Then there was a decided awakening to the practical value of the electric vehicle. Firms of large magnitude, that had used one or several for varying periods, began to add them to delivery equipment and to replace horse vehicles wherever the hauls were not of extreme length. Public service corporations furnishing electric energy, commercially realized the business possibilities through promotion of the use of these machines. A considerable number of the central stations adopted electrics for their own service and several have established garages where systematic care and attention can be given those who have one or more vehicles, yet whose equipment is not sufficient to justify establishing a private garage. There are today in the United States about 150 central stations that have in service from one to 100 electric wagons and carriages of different types. Some of these are using gasoline vehicles as well, but wherever it is possible the electrics are used.

In the United States there are approximately 30,000 central stations which can be a source of supply for electric energy for vehicles. Some of these serve large areas and some have established sub-stations where vehicle charging is done. It is entirely within possibilities for charging stations to be located at such frequent intervals that touring could be done by electric with absolute certainty of securing power wherever needed. For commercial service, however, the distances need not be long, and it is maintained that practically 80 per cent. of the highway haulage is within the radius of movement of electric wagons.

The number of manufacturers of electric vehicles is increasing. There has been a very pronounced development of the industry, with reference to both pleasure and service machines. Several concerns now build both electric and gasoline wagons and there is general recognition of the fact that each type is adapted for specific work and each has a distinct field. The machines are designed with great care, constructed of the finest of material, and are from every viewpoint far more dependable and enduring than those which have given such remarkable service. The period of usefulness or service of an electric wagon is generally fixed at 10 years with reasonable maintenance and upkeep, but this can be regarded as decidedly conservative if systematic attention is given.

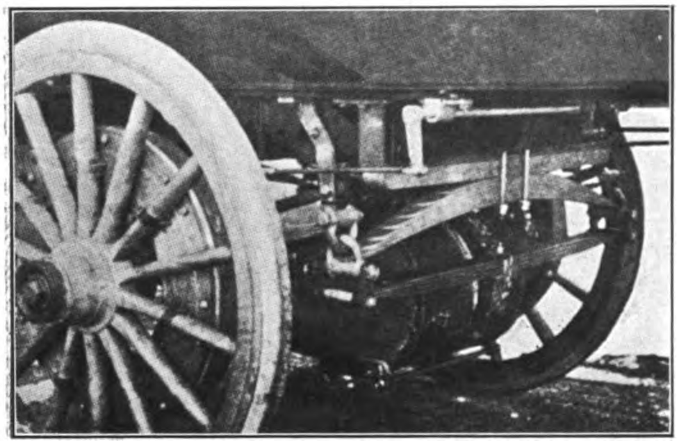
Five-Ton Vehicle Equipment Truck Purchased in 1903 by Stern Brothers, New York City, and Used in Transfer Service Between the Store in 23rd Street and Harlem, Making 40 Miles Each Working Day.

The owner of electric vehicles will usually find that the larger the number in use the greater the economy obtained, because the number of men required to properly care for them is comparatively small. In fact, a crew for a large garage is but a few men, and all these need not be expert, as there is considerable labor needed that does not entail mechanical knowledge or skill. The equipment for charging is not expensive and when once installed it should be serviceable for a period of years. The rate of insurance is low as compared with gasoline machines. Horse drivers who are familiar with the streets and localities and the traffic can be employed.

The public service station can be independent of or incorporated with the service of the central station. It may be a private enterprise or it may be a department, according to the desires of the management, and it may be conducted to a system that will insure the height of attention. The exclusive service wagon garage is certain to be as much of a business as the pleasure garage is today, and it is not impracticable for such a service to be conducted on a co-operative plan, in which each member or owner will receive a guaranteed quality of work and care.

There is, of course, a point where the owner of a delivery service will secure the greater economy by maintaining his own garage, but this will differ materially and is largely dependent upon conditions. It cannot be determined save with reference to each particular case and there is no rule that can be applied, for many factors must be considered. One of these is the rental, another is the cost of current, a third is the number of machines to be cared for, a fourth is the manner of use, a fifth is the character of attention desired, a sixth is the service with reference to battery

maintenance, a seventh is the labor, an eighth is the knowledge of the machines, a ninth is the stock of spares and material that should be carried, a tenth is



The Rear Construction of the First Columbia Heavy Delivery Wagons.

the garage equipment, and besides these there is the probable expansion to be considered.

The cost must be carefully estimated, and when this has been compared, with the garage charge for service and the other expense a reasonably definite conclusion can be arrived at. But it is apparent that there will be variance with each particular service and it is not possible to apply a rule that will serve equally well with all. Where the current may be bought cheaply as compared with other localities, there may be less, or even no reason to make energy, and where the requirement is very large it may be very profitable to do so. Where a power plant is operated current production is generally practical. In some instances it has been found economical to make energy with but one or two machines to charge.

A custom with many of the central stations is to sell current by a scale of prices, so that the large consumer pays less a kilowatt-hour than one using less, and it may be that such a system of charging would bring the cost very low for a garage of considerable proportions. Not only this, the continuance of the garage service must be considered rather than the monthly charge. Of course there are the maintenance and tire bills to be added to the public garage service cost, although there are garages that will make contract for maintenance and attention, but these are very infrequent.

It is not possible to estimate the labor required because of the varying capabilities of men who may be employed. A batteryman is needed in every garage of proportions, and he can be a very large economy if he is expert. The charging should be entrusted to a man who has been well trained and can determine conditions from his observations of the instruments. Occasionally a mechanic can be obtained who can care for the wagons and do the charging. In most garages of size the work is not combined, but it could be performed by one man to good advantage.

Reference is made to these factors because they are of much importance in any garage proposition. It is expected that the public station will have the service of men of sufficient experience and skill to do whatever work is necessary, and that the management will always have the machines ready for use when required unless it is impossible to do so.

(To Be Continued.)

CALIFORNIA OWNERS WIN.

Recently Organized Motor Truck Club in Los Angeles Secures Proper Consideration of Taxation Plan.

The Motor Truck Club at Los Angeles, Cal., which was recently organized, has already demonstrated its usefulness and value to motor truck owners, in having secured proper representation before the city council. The latter had prepared an ordinance requiring a local tax on commercial motor vehicles, based on the horsepower rating. A conference was held with the city attorney with the result that the ordinance was amended on the tonnage basis, as follows: Motor trucks of less than one ton capacity, $5 a year; one to two tons, $10; two to five, $20; more than five, $25.

An attempt is to be made to revive the proposed state registration bill, which failed to secure the approval of Gov. Johnson last year after having been passed in the legislature. Under the present regulations California owners are required to register their machines but once, the fee being $2. The new law would provide an annual fee, as follows: Less than 20 horsepower, $3; 20-30, $5; 30-40, $7.50; 40-50, $10; 50-60, $12.50; over 60, $15; motorcycles, $2; manufacturers and agents and dealers having the whole state

The First Baker Electric Runabout, in Which the Motor and Rear Axle Were Combined.

territory, $25; agents and dealers with less than entire state territory, $10. This schedule is claimed to be excessive, as it covers old and new machines alike.

TESTING CABLES WITH ELECTRIC TRUCKS.

Boston Edison Company's Equipment to Determine Condition of Power and Light Mains the Only Apparatus of the Kind—A Very Valuable Installation.

WHAT is an unusual use for motor trucks is made of two General Vehicle five-ton machines by the Edison Electric Illuminating Company of Boston, which has had constructed what is, so far as is known, the only portable cable testing apparatus in the world. The value of the equipment from a monetary point of view is large, and its use may seem comparatively limited, but that there is economy for a public service corporation of the proportions of the Boston company to utilize such method of test can be judged from the fact that the trucks were purchased and equipped after careful estimate of the expense and the possibilities.

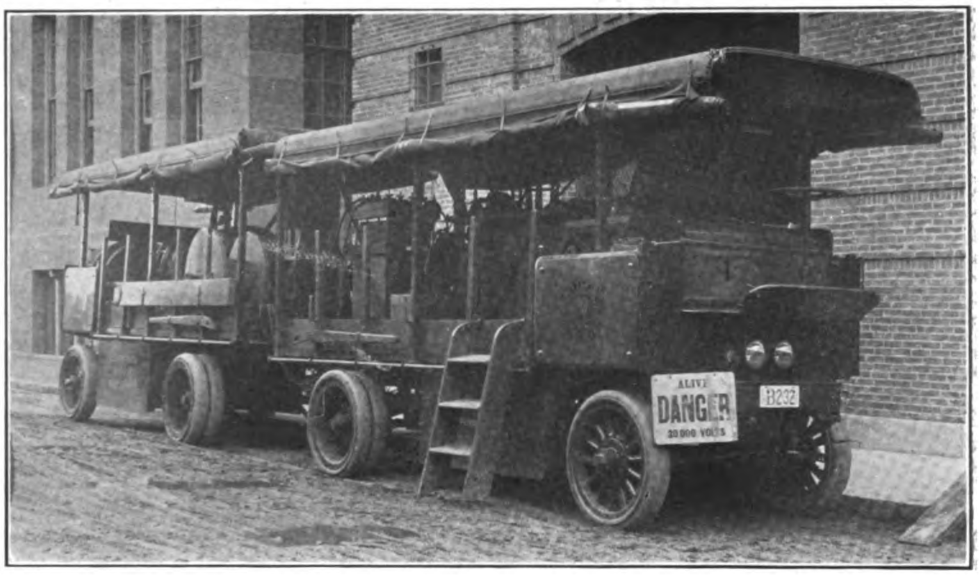
The area of the cities and towns served by the company is about 550 square miles and there are 38 different municipalities. In this section, which is about half the size of the state of Rhode Island, and has about three times the population of that state, the distribution of current is by cable mains. The construction is often in the form of conduits and in these the cables are stretched. There are manholes at frequent intervals that afford access to the cables and conduits. The demand for underground mains is increasing each year from the necessity of safeguarding the public and to avoid the possibilities of damage or destruction from severe storms. The protected cables cost more and the construction is regarded as being practically permanent, and to insure the greatest degree of permanency the new cables are tested carefully, while mains that are suspected of deterioration are also examined and tried to ascertain whether or not they are equal to the loads carried.

While tests were made prior to the building of the apparatus with a reasonable degree of certainty, it was believed it would be best to secure more definite determinations, and with this purpose in mind the company's engineering staff prepared the plans for a portable equipment. Technically it is known as a high potential cable testing set, and it is used by the laboratory department in testing the underground, lead encased mains. These cables are composed of varying series of copper wire imbedded in and protected by insulating material which is surrounded by the circular coating of lead.

When the cables are manufactured they are, if a single or a series of wires, first insulated, and the expectation is that this process is uniform. After the insulating they are passed through a machine that applies the lead coating or cover. The lead is expected to be a thorough protection against ordinary causes of deterioration, and they are expected to be impervious to influence of continued immersion in water. The cables are inspected, passed as perfect and delivered with a guarantee of specific capacity, which is the basis of the work required of them. That is, the cables are provided with a view of the requirements, and there is a cértain factor of safety allowed. There are, however, reasons why the cables may be subjected to overloads under certain conditions, and it is desired to test them to the capacities.

With this apparatus all kinds of underground lead cables, such as three-conductor high voltage transmission, single and three-conductor low voltage transmission and distribution, and arc circuit cables, are tested. With new cable the test is principally made to prove the manufacturers' guarantee, and with old cable the purpose is to determine its condition and prevent failures. The test consists of applying a voltage in excess of the normal operating voltage for a certain length of time, and if the cable endures the trial it is approved, but if the cable insulation is punctured it proves that it was defective—at least at the place of puncture.

The apparatus comprising the set is mounted permanently on two electric trucks, which are numbered 1 and 2, and which are rated at five and six tons, respectively. Truck No. 1 weighs complete approximately 21,000 pounds, and Truck No. 2 23,000 pounds. The machines are the General Vehicle five-ton chassis



Boston Edison Company's Portable Cable Testing Set, Mounted on Two Five-Ton General Vehicle Trucks, Ready for Service.

with extra heavy springs. While not in use the chassis frames are jacked to relieve the springs and prevent them taking a permanent set that would reduce their resiliency and efficiency. Were the springs not jacked it would be necessary to frequently replace them.

The trucks are intended to be driven about 30 miles on one battery charge and have a maximum speed of about 7.5 miles an hour. They are equipped with Edison A-12 60-cell batteries, which are divided into 12 crates of five cells each for convenience in handling. Each truck is fitted with a single five horsepower motor. There is one set of external band brake shoes on the rear wheels, but it is purposed to fit an additional set of brakes on the countershafts, and besides this the reverse may be used for retardation. Extra curtains have been provided for each machine to protect the electrical equipment from storms. Electric lights are fitted to the trucks and fire extinguishers are provided to meet any emergency. All of the electrical testing machines and apparatus are mounted on the decks of the platforms and are fully protected by the canopy and the curtains.

Truck No. 1, on Which Is Mounted the Transformer and Auxiliaries for Using a Current of 30,000 Volts Through a Cable.

The testing equipment installed on No. 1 truck is as follows: One 800 K. V. A. 2300-volt to 15,000/30,000 60-cycle, air-blast transformer; one 850 K. V. A. 60-cycle, air-blast portable reactance; two motor driven blower sets; one five K. W. transformer for blower motors; one 15,000-volt potential instrument transformer; one spark gap and resistance; one complete switchboard; one set of cable fault locating apparatus; one set of jumper cables, together with a complete galvanometer outfit, tools, jacks, rope and all other auxiliary apparatus.

On Truck No. 2 is installed one 100 K. W. motor-generator set, consisting of a 100 horsepower 60-cycle three-phase 2300/4000 induction motor, connected through a flexible coupling to a 100 K. W. 60-cycle 2300-volt three-phase synchronous generator having a two K. W. exciter mounted directly on its shaft; one starting compensator, one complete switchboard, one set of jumper cables, one set of portable motors and auxiliary equipment.

All of the electrical testing apparatus is so mounted mechanically that it will not become loosened or be damaged by the vibration of the truck as it is driven over the inequalities of the street and road surfaces. To accomplish this purpose it has been found necessary to strongly brace it and use washers and check nuts with all bolts. All of the exposed, important wiring is protected by metal conduits. The layout of the entire apparatus, and that of the switchboards, is such that a test can be quickly made, and the number of connections is minimized.

The manner of using the trucks in making a test is as follows: From the garage the trucks are driven to the location where the test is to be, where they are connected and the motors placed in circuit. Power is obtained by jumper cables from the nearest source of current, such as a sub-station, an overhead or an underground wire, but this power must be three-phase 60-cycle 2300 to 4000-volt, which is used to drive the 100 horsepower motor.

The generator driven by the motor produces a variable voltage from zero to 2300 volts, with 100 K. V. A. capacity at 2300 volts. This voltage is stepped-up or intensified by the 800 K. V. A. transformer to 30,000 volts, when the generator is giving 2300 volts. The 30,000 volts is impressed on the cable under test and all the necessary readings are taken. The reactance is connected in multiple with the 2300-volt side of the step-up transformer, and its function is to neutralize the leading current, due to the cable condenser action. The reactance is provided with a series of taps so that just the amount necessary can be connected at any specified test.

The apparatus has been used to make approximately 180 tests up to the present time and has proven to be decidedly successful for the purpose designed. During these tests much data has been obtained, both from the electrical cable and the vehicle service viewpoints. A log has been kept of the different works, from which data a series of curves have been plotted, these showing the ampere-hours used a mile, a work, and the number of miles driven a work or test.

The machines have been in service during the

greater part of the present year, and while they have not been driven a mileage that would be compared with machines used wholly for haulage, they have been given a very unusual test as they have been heavily loaded since the apparatus was installed upon them. They are probably the only two vehicles in service in the world that are never unloaded. Aside from jacking the frames to relieve the springs this also prevents maximum weight on the tires, which would undoubtedly be destructive of shoes.

ELECTRIC VEHICLE ASSOCIATION.

Plans Developing for Increasing Appropriation Providing for Dissemination of Information.

The headquarters of the Electric Vehicle Association of America are at 124 West 42nd street, New York City, which is the office of Secretary Harvey Robinson, and here on the fourth Tuesday of each month is held a meeting of the board of directors, at which time the business affairs are considered. The monthly meetings of the association for members are held at stated places the evening of the same day, when subjects of general interest are discussed and decided.

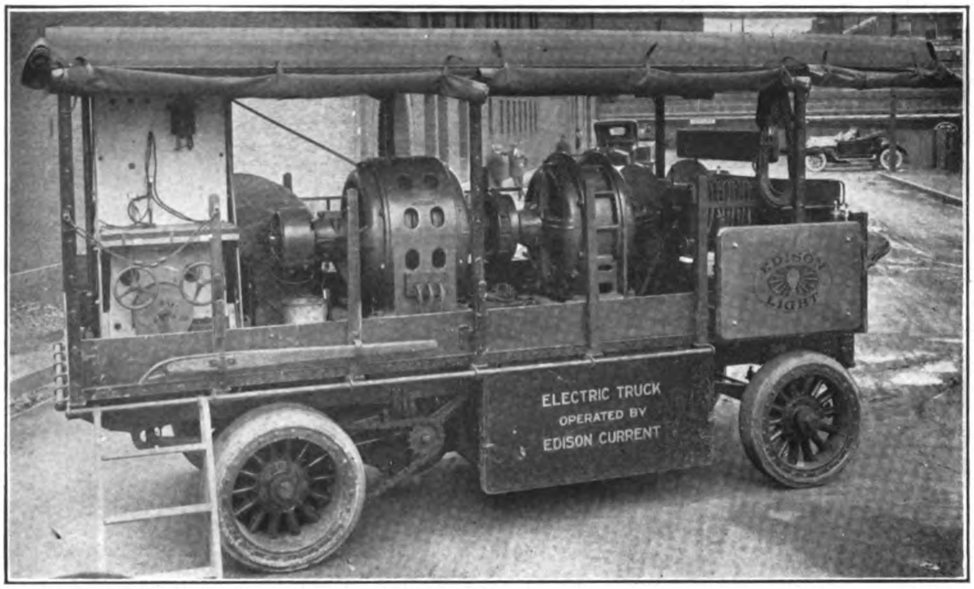
It is the intention of the association to devote more careful attention to publicity the present year, and the subject of advertising will be taken up systematically, probably under the direction of the publicity and advertising committee.

At the convention in Boston in October a number of subjects were given presentation that were deserving of more studied inquiry, and as the discussion at that time has been published, these printed reports are to be systematically debated with a view of developing opinions. Many valuable suggestions were made and it is purposed that these be taken up in connection with the monthly meetings and the ideas crystallized so far as this may be done. That the members may have the fullest information on the subjects copies of the printed reports have been mailed to them.

As an example of the value of these meetings may be stated that at which President Arthur Williams presided for the first time. One paper read at the Boston convention stated that there was a saving of $400 a year by the use of a 1000-pound electric wagon in the place of a horse vehicle, and $1100 a year by the use of a five-ton electric in the place of a horse equipment capable of doing the same work. After very carefully going into the subject it was decided that these figures were conservative and could be safely stated as an average.

The association has as a whole approved the campaign of publicity that was inaugurated more than a year ago, and so confident are the members of the value of systematically advertising the economy of the electric vehicle that the sentiment appears to be favorable to the expenditure of $100,000 for this form of promotion during the present year. The first year's expense for advertising was somewhat in excess of $40,000, and with the experience gained it was believed that the association would be justified in expending $100,000, which amount was recommended by the committee on advertising and publicity. This committee is now raising the fund for advertising and with a view of securing the amount stated.

The standard garage sign of the association is to be conspicuously placed in one or more locations in main thoroughfares of all communities where a garage



Truck No. 2, Which Carries the Motor-Generator and Equipment for Generating the Energy Supplied to the Transformer.

exists that has vehicle charging facilities. The sign is 48 inches length and 30 inches depth and has a background of blue, on which in large white letters is "Electric Vehicle Charging," and the emblem of the organization. The desire is to have these signs direct attention to garages that can afford satisfactory service.

The December meeting of the association was held the evening of the 17th, a week earlier than usual, for the regular night would have been Christmas Eve, at the Engineering Societies' Building, 29 West 39th street, New York City. The principal paper was on the subject of "The Central Station Influence on the Electric Vehicle Industry," and was prepared by S. G. Thompson of the Public Service Electric Company, Newark, N. J.

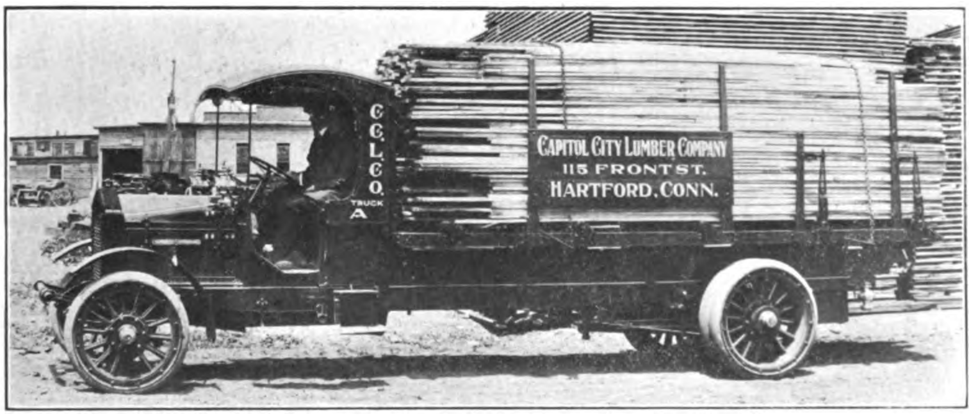
Benjamin Briscoe has resigned as director and secretary of the Automobile Board of Trade. John N. Willys becomes a director and Roy D. Chapin secretary.

PIERCE-ARROW TRUCK EQUAL TO 11 HORSES.

THE Capitol City Lumber Company, Hartford, Conn., a concern with an extensive business in that city and its suburbs, has had a Pierce-Arrow five-ton truck in its service since shortly before the first of September, and has realized a surprising degree of economy from its use. While the experience with the machine has been comparatively brief the company has been exceedingly careful to obtain information that is dependable and is keeping accurate record of the work accomplished and the cost.

When the machine was purchased a system of accounting for its service and the expense was devised, and an estimate made of the probable cost, considering every item of overhead or fixed charges. As against this the company has a very good knowledge of delivery by horses and the approximate expenditure for this department for years. The truck was purchased with a platform body with rollers installed in the deck to facilitate the handling of loads.

A four-wheeled wagon was fitted for loading the truck. This wagon is kept at the yard and when an order is received that will be delivered by the machine it is selected and packed on the wagon, which is then hauled to a convenient place in the yard. When the truck is in the yard it is backed to one end of the wagon and the load is transferred with comparatively little effort, the average time being about three minutes. The machine is then hustled away and it is unloaded in an average of about two minutes.



Pierce-Arrow Truck That Takes the Place of 5.5 Two-Horse Teams in the Service of the Capitol City Lumber Company, Hartford, Conn.

The truck will carry 5000 feet of dressed lumber as a load against 2500 feet for a two-horse team and wagon, and will make an average of 8.5 trips of five miles each, daily, covering 42.5 miles, while the animal outfit will make but three trips of five miles each, a total of 15 miles. The deduction is that the truck takes the place of 5.5 two-horse teams, and it is estimated that it will deliver lumber at 36 cents a 1000 feet as against a cost of 75 cents by two-horse team delivery. No statement is made as to the number of men the crew replaces, but the conclusion is that the same number attend the truck that would attend a regular horse outfit. The following figures are based on total investment, overhead, insurance, upkeep, repairs, operation, etc., with reference to both the truck and to a horse equipment unit:

	Pierce-Arrow Truck	Two-Horse Team
Total investment—with equipment	$5362.12	$1510.00
Total daily expense	15.26	5.63
Average daily mileage	42.5	15
Average round trip haul, miles	5	5
Average number trips a day	8.5	3
Average load, dressed lumber, feet	5000	2500
Average weight of load, tons	5	2.5
Total of loads carried daily, feet	42,500	7500
Total expense a 1000 feet, cents	36	75

AN ELASTIC SYSTEM.

Philadelphia Chemical Company Reaping All Advantages Claimed for Motor Truck Service.

The Baugh & Sons Company, manufacturing chemist of Philadelphia, has been operating five Peerless trucks, made by the Peerless Motor Car Company, Cleveland, O., and reports that the conditions surrounding its transportation problem have been such that it has profited by practically every advantage that is claimed for motor truck service. Four of the trucks are of three tons capacity and are used to collect raw material about the city and to deliver it at the Baugh plant. The fifth truck, which carries five tons, is used to transport the completed product from the plant to the various railroad stations and to the wharves.

The four three-ton trucks cover a wider territory than the teams they displaced. They make quicker trips and as the materials they handle deteriorate rapidly they deliver them at the plant in better condition and materially increase their value. Snow, slush and slippery hills, which are dangerous to horses, have given them no trouble. Very hot weather does not decrease the efficiency of the service. As the trucks can work overtime when necessary the system is elastic and a saving is effected in every branch of the work.

J. G. Brown, manager of a large brewery in Roxbury, Mass., states that the Packard trucks recently purchased by his concern have demonstrated their efficiency over horses beyond comparison. The company purchased the trucks on Sept. 24, Oct. 24 and Oct. 26, respectively, and no horses are now maintained. Two three-ton trucks take care of the barrel deliveries and one two-ton vehicle handles successfully the bottled goods trade. It is needless to say that the entire equipment has proven highly satisfactory.

Municipal Service Equipment

SOME NEW KNOX VEHICLES.

Massachusetts Cities Well Satisfied with Economy and Efficiency of This Equipment.

The Knox Automobile Company, Springfield, Mass., has delivered two more Knox cars to the city officials of Lynn, Mass., these consisting of a model M-3 combination hose and chemical wagon and a model R-64 combination patrol and ambulance. Both machines were driven over road from the factory and received much favorable comment from public authorities on the way. Lynn already has one Knox patrol and a Knox combination fire wagon of similar type, and the repeat order was decidedly gratifying to the Knox company.

Another new fire wagon of this make was delivered recently in Wakefield, Mass., and very soon after its acceptance it was called out on an alarm from the residential section. It was at the scene of the blaze within three minutes of the time the bell began sounding. The house was fully 1800 feet from a hydrant and this vehicle, which is of the triple combination type, was at work pumping water so soon as the hydrant was connected. The town officials were especially well pleased with the performance and expressed themselves as abundantly convinced of the efficiency of this particular apparatus.

In response to the desire of the fire engineers in Gardner, Mass., to test the Knox Martin tractor in what was regarded as severe work for a machine of this character, the company recently drove one of these vehicles to that town. The engineers were confident the tractor could not haul their steam engine up the steep hills in that section, but after taking the hook and ladder apparatus up the incline the steamer was handled in the same expeditious manner. As a result the town expects to purchase a tractor.

ECONOMY IN SPOKANE DEPARTMENT.

Careful Records for Nine Months Demonstrate Increased Efficiency with Motor Apparatus.

Commissioner Hayden of the fire department of Spokane, Wash., has concluded, from records kept by the department in that city, that motor driven fire apparatus can respond to twice as many fires, travel farther and carry more weight at less than quarter of the upkeep expense of horse drawn apparatus. It will be seen by a comparative record kept by Commissioner Hayden of two hose wagons of the Spokane department, that the motor apparatus travelled 49.72 miles more than did the horse drawn vehicle, while answering 86 more alarms. And this increased mileage and efficiency was accomplished at a cost of $234.43 less than was registered for the maintenance of the horse drawn drawn apparatus. The record follows:

Knox Patrol Wagon and Combination Hose and Chemical Engine, Comprising a Repeat Order from the City of Lynn, Mass.

Hose Wagon No. 9, Horse Drawn.
(Report for Jan. 1-Sept. 30, 1912).

Shoeing horses	$71.90
Forage	214.40
Repairs	.60
General supplies	19.60
Total	$306.50

Total alarms answered, 73.
Miles travelled, 148.78.

Hose Wagon No. 5, Motor Driven.
(Report for same period.)

Oils and gasoline	$29.67
Repairs	20.03
General supplies	22.37
Total	$72.07

Total alarms answered, 139.
Total miles travelled, 198.5.

DETROIT'S MOTOR EQUIPMENT.

Head of Fire Department Has Proceeded Cautiously but Now Is Well Supplied with Automobiles.

Proceeding cautiously during the first stages of the development in automobile fire apparatus, Detroit, Mich., now boasts of a motorized fire department as well equipped as most cities of its size in the country. Chief Broderick carefully studied the problem and did not invest until he felt sure that the machines he purchased would not be declared obsolete in a few months and would have to be discarded.

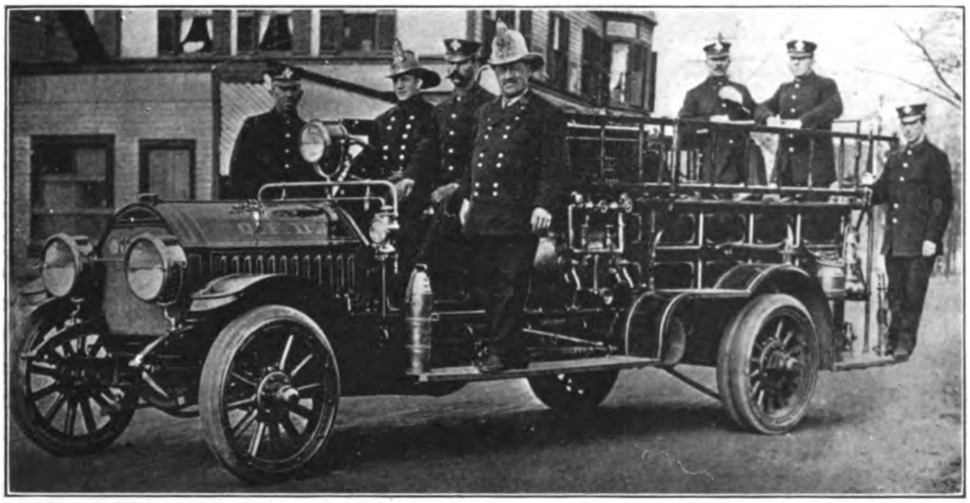
Detroit was one of the first cities to install a flying squadron. Now there are two high powered cars, each carrying a dozen men whose duty it is to respond to all calls in their district and join with others of the department in handling the apparatus. It is not long since the first motor pumping engine went into service and now five of these have taken the place of as many steam engines and others will soon be added. Two ladder trucks have been motorized with more to follow in due season, and Chief Broderick and each of the six battalion chiefs answer alarms in automobiles provided for their official use. It is only a question of time before horses will be unknown in the Detroit fire department.

"The death knell of the horse has been sounded, much as some of us who have been with the department so long may regret, from purely sentimental reasons," says Chief Broderick. "Motor driven apparatus is not an unqualified success in every respect as yet. It will come eventually, but while this changing over is taking place and improvements are so frequent it is just as well to proceed cautiously. We are adding motor apparatus at a pretty good rate, but we want to make sure as we go along that it is the best obtainable."

KISSELKARS IN QUINCY, MASS.

Two Pieces Added to Fire Department's Equipment After Satisfactory Test of Original Purchase.

The fire department in Quincy, Mass., has just added to its equipment a new KisselKar combination wagon and a KisselKar chief's car, made by the Kissel Motor Car Company, Hartford, Wis. The chief's car was formerly a touring car used for demonstration purposes by the Kissel company. The rear seat was displaced by a 25-gallon chemical tank. The tank is the same as used for big combination wagons and carries 150 feet of small hose. The machine also is equipped with an axe and crowbar. The new combination wagon is larger than the first one installed by the city and carries two chemical tanks, 200 feet of small hose, 1000 feet of large hose, second-story and roof ladders, axes, crowbars and other appliances. The engines are six-cylinder and of 60 horsepower. On a recent test, fully equipped and carrying in addition 21 men, the machine climbed the steepest hills in the city with apparent ease.



KisselKar Combination Fire Wagon Recently Placed in Service in Quincy, Mass.

GENERAL NEWS FROM OTHER CITIES.

Seeking to Convert Steamers—The motor fire apparatus at Baltimore, Md., has been such a success that the fire board has decided to ask the board of estimates to grant an appropriation to convert at least four of the engines into automobile steamers. It is also planned to replace the horse drawn vehicles used by the district chiefs with motor wagons similar to those used by the chief and deputy chief.

Recommends Motor Apparatus—The National Board of Fire Underwriters has filed a report of a recent inspection of the fire-fighting facilities in Indianapolis, Ind. The board recommends that all new apparatus bought for the department and all apparatus of companies making long runs on the first alarm shall be motor vehicles.

Pope-Hartford for Fairhaven—Fairhaven, Mass., has received from the factory of the Pope Manufacturing Company, Hartford, Conn., a new Pope-Hartford motor chemical wagon. The vehicle is double tanked and is larger than any of those located in the city of New Bedford, Mass., which is near Fairhaven. It is an unusually attractive car, with ladders well inside the line of the wheels. The truck has double chain drive, and has a chemical tank of 35-40 gallon capacity. It has three compartments carrying 600 feet of hose on each side, 250 feet of chemical hose, four chemical extinguishers and two Pyrene extinguishers. The ladder equipment comprises a 35-foot triple extension and 12-foot inside pole ladder, which collapses for handy carrying. The machine has a wheelbase of 148 inches and carries 12 men.

Quick Long Distance Run—The value of motor fire apparatus was recently demonstrated at a fire in Essex Junction, Vt., when Johnson's hotel was destroyed with a loss of $25,000. That this was not greater was due to the quick response to a call for outside aid by the motor fire truck from Burlington, Vt. The vehicle with its crew made the run of seven miles to Essex Junction in eight minutes. This was considered all the more remarkable in view of the fact that it was made at night. Immediately after the arrival of the Burlington firemen with the modern apparatus, the fire was placed under control and its spread prevented.

To Install Electric Pumping System—Going even a step beyond the aims of most cities that are seeking to introduce automobile fire fighting apparatus on a large scale, municipal authorities at Cleveland, O., are at work on a plan to adopt an electric pumping system, patterned somewhat after that employed in the city of Berlin, Germany. With the co-operation of the city lighting system, electrical connecting plugs will be established beside the water plugs, so that current for operating the pumps may be obtained directly. The pumps will be mounted on automobile chassis and manufacturers estimate that equipment to pump 1000 gallons a minute will weigh about three tons each and cost in the neighborhood of $2000.

White Truck with Interchangeable Bodies—The overseers of the poor of Worcester, Mass., have purchased a 30 horsepower, three-ton, gasoline driven motor truck chassis of the White Company, Cleveland, O., to which two or three changeable bodies will be fitted. The machine will be used to haul supplies, such as coal, hay, grain and other commodities, to the home farm, for carting away live stock and many other uses. It is the intention of the overseers to experiment with the new truck in making special garbage collection trips from markets, hotels and other places, and it is expected that the first season there will be saved the first cost of $600 for a pair of draft horses and their maintenance.

New Orleans Adds Two Pieces—The city of New Orleans has installed a new automobile aerial truck and two runabouts to be used by assistant chiefs of the fire department. The runabouts have a capacity of 30 horsepower and were made by the Buick Motor Company, Flint, Mich. The reconstructed aerial truck is of 80 horsepower and has an 85-foot ladder. The apparatus will respond to alarms in the business section of the city. It was constructed by the Seagrave Company, Columbus, O.

South Manchester Buys a White—The White Company, Cleveland, O., has made delivery of a motor hose wagon to the fire department of South Manchester, Conn., and it is now in active service. It has the 1500-pound chassis such as is used on the White trucks and is equipped with two chemical extinguishers, two nozzle stands, two nozzles, chemical and fire hose, extra ladders, etc. The engine is rated at 30 horsepower and among the features more peculiar to a fire automobile are electric ignition for the gas lamps, United States non-skid chain tires and automatic air pump.

In the Market—Following are some of the cities that are in the market to purchase motor driven fire apparatus: Lebanon, Penn.; San Jose, Cal.; Orange, Mass.; Providence, R. I.; Venise, Cal.; Woburn, Mass.; Milbury, Mass.; Melrose, Mass.; Beverly, Mass.; Waycross, Ga.; Cedar Rapids, Ia.; Lockport, N. Y.; Sidney, O.; Garden City, Kan.; Beaver, Penn.; Hopkinton, Mass.; Kingston, N. Y.; Halesite, N. Y.; Roselle, N. J.; Swampscott, Mass.; Chatham, N. J.; Bayonne City, N. J.; Aberdeen, S. D.; Farrell, Penn.; Sioux Falls, S. D.; Palestine, Tex.; Harrisburg, Penn.; Sherman, Tex.; Knoxville, Tenn.; Hallettsville, Tex.; Amsterdam, N. Y.; Springfield, Mo.; Englewood, N. J.; Joplin, Mo.; Haverhill, Mass.; Pueblo, Col.; Utica, N. Y.; Goliad, Tex.; Billings, Mont.

Recent American-La France Deliveries—The American-La France Fire Engine Company, Elmira, N. Y., maker of motor fire apparatus, recently made deliveries of motor propelled vehicles to the following cities: Hot Springs, Ark.; Houston, Tex.; Fort Worth, Tex.; Memphis, Tenn.; Shreveport, La.; Zanesville, O.; Tuckahoe, N. Y.; Ocean Grove, N. J.; Elizabeth, N. J. The following orders for apparatus have been received: Astoria, Ore.; Pueblo, Col.; Palatka, Fla.; Tarboro, N. C.; Decatur, Ala.; Dayton, O.; Raleigh, N. C.; Warren, Penn.; Boston, Mass.; Greenwood, Miss.; Beverly, Mass.; Point Grey, B. C.; Salisbury, S. C.; Duluth, Minn.; Quitman, Ga.; Vancouver, B. C.; Halifax, N. S.; El Paso, Tex.; Somerville, Mass.; Danville, Va.; Danbury, Conn.; Atlanta, Ga.; Winston, N. C.; Belmont, Mass.; St. Petersburg, Fla.; Park City, Tenn.; Richwood, O.; South Bend, Ind.; San Antonio, Tex.; San Francisco, Cal.; Boston, Mass.; Manchester, N. H.; Richmond, Va.; Yonkers, N. Y.; Manila, P. I.; Pittsfield, Mass.

The Motor Truck
Devoted to Motor Driven Business Vehicles of All Classes.

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Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.
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THE BUYER AT THE TRUCK SHOW.

The value of the display of service vehicles to the man making a study of transportation problems and machines is in the opportunity it affords him to make comparisons of types that will serve his purposes. The man who proposes to make investment of a considerable amount of money generally desires to learn what he can of machines he believes worthy of consideration, and while it is not probable he will make decision without careful reflection he will undoubtedly avail himself of every opportunity to secure information that will benefit him.

The man who is investigating the use of motor wagons may have specific uses in mind, but what he wants to know is whether the machine of which he is inquiring will meet these needs. All the mechanical descriptions ever conceived will not supply this information, although interestingly told. Work accomplished and the experience of those who have used such machines in similar haulage or transportation are facts that will interest the visitor. Some practical expense statements and facts relative to care and maintenance are worth presentation, because they have the merit of actual service and are not theories or suppositions.

The business man judges from his own estimate of value and he is more inclined to accept conservative statements, or the results found by those who have used vehicles, than to be convinced by rehearsal of instances that at best may be demonstrations made by experts, who have intimate knowledge of the machine and who have every reason to make the greatest showing possible.

CONTROL OF SERVICE WAGONS.

The increase in the number of accidents resulting from the use of service wagons, especially that class where the victims are careless or regardless of the probable dangers, emphasizes that too great care cannot be given by designers to perfecting the methods of control. By this is meant that the brakes should be extremely powerful and sufficient to stop a machine in a very short distance. The statement is not a reflection upon existing vehicles or designs, but with traffic increasing in the streets and the pedestrians rapidly multiplying in numbers, the protection of the public and the owners and operators of vehicles is imperative.

The carelessness of the people is well known and despite the greatest care by the drivers it is impossible to avoid accidents, but with brakes that will make certain that a machine can be stopped in a very few feet there will be a greater degree of protection than now exists. It is not merely a question of holding a vehicle and its load on a grade, or stopping in a given distance, but it is a proposal to stop a machine against its momentum at maximum speed in the briefest time as a safeguard against accident or fatality. Accidents may be excusable, but it is far better to have construction that will minimize them, if not prevent them.

THE PROBLEM OF TRUCK TIRES.

The cost of service vehicle tires is regarded by practically every owner and user of a motor wagon as being the largest item of expense and the most important problem to be dealt with. The experience of those using pneumatic shoes is that the larger sizes wear longer and give the best service, to say nothing of the greater comfort and the lessened vehicle repair bills. The experience of English service wagon owners is that with large tires the greatest economy is obtained. The British makers equip their vehicles with larger sizes as a rule than do American builders. This leads to the supposition that it might be more economical to use larger tires than are now regarded as sufficient for the load carried in this country. This would necessarily increase the initial cost, but it might be an expense that would be justified by results, both as regards tires and vehicle maintenance.

SOLVING THE SUBURBAN DELIVERY PROBLEM.

Furniture House in Louisville, Ky., Finds Its Answer in Mais Truck—No Comparison Possible in Matter of Efficiency—Figures Show Undoubted Economy.

By G. D. Crain, Jr.

ECONOMY is the argument to which chief attention is paid in presenting the merits of the motor truck for the consideration of the prospective user. In a measure, this is the result of a desire on the part of the business man to learn whether he can save money by installing power driven vehicles instead of continuing to use his horse drawn equipment. And stress likewise is laid on the ability of the mechanical transport to accomplish a certain amount of work which cannot be done with the older type of delivery.

There are instances, however, in which the introduction of the modern method of haulage has not been due to a consideration of either economy or efficiency, but to the fact it is capable of providing service which was utterly out of the question under the old system. Inasmuch as such use of the truck is largely dependent upon initiating work that was never attempted before, this feature is of prime importance.

It should be remembered that inertia is a decided factor in the prevention of sales, and that where a merchant or manufacturer has a complete equipment of horse drawn apparatus from which he is obtaining fair satisfaction even though it can be shown that it is more expensive than the mechanical transport would be, he hesitates to make the investment necessitated by the change. But when it becomes possible to show him that the truck offers him something he can get in no other manner, the effort is much easier.

For the purpose of illustration, the furniture business may be selected. In this line, especially in some of the cities outside of the larger metropolitan centres, the business done with the people of the outlying sections and in the important farming communities immediately adjacent thereto is sufficient in the aggregate to become an item worthy of decided consideration.

The delivery problem has been one of the chief troubles of the furniture dealer. Getting the purchase from the store to the distant customer is a proposition that under the usual system of horse drawn equipment involves crating the goods at the store, hauling them to the depot, shipping by rail to the station nearest the purchaser, and then arranging for the completion of the haul to his home.

To begin with this system is slow and expensive. In addition, it is unsatisfactory to the customer because of the inconvenience of having to make the final delivery, and because the furniture frequently is damaged in transit. There seemed to be no way out of the difficulty, however, until the motor truck was given a trial, and it fully met expectations.

To cite a specific instance, reference may be had to the Denhard Company of Louisville, Ky., one of the largest retail furniture concerns in the Ohio valley and

Mais 3000-Pound Truck in Furniture Delivery Service with the Denhard Company, Louisville, Ky.

one of the most successful operators of the mechanical transport in making long distance deliveries of the nature indicated. The experience of this concern has been such as to demonstrate that not only is it possible to solve this problem in an efficient and economical manner, but to attract and retain custom that could be obtained in no other way.

Louisville is in the heart of a rich agricultural district, and the business of the Denhard Company extends over a radius of 30 miles in all directions. It had developed this market until it had reached proportions almost as important as the purely local business with the residents of the city itself, when it became evident that this suburban trade, while satisfactory in all other respects, was far from being so in connection with the

DENHARD COMPANY'S COMPARATIVE FIGURES.

Monthly Cost of Two-Horse Team.

Feed	$30.00
Shoeing	4.00
Repairs	3.00
Driver	65.00
Helper	40.00
Total for one team	$142.00
Total for three teams	$426.00

Monthly Cost of Mais Truck.

Gasoline	$16.90
Oil	4.00
Grease	1.50
Tires and overhaul	20.00
Driver	78.00
Helper	40.00
Total for truck	$160.40
Balance in favor of truck	$265.60

delivery of goods. Customers were irritated by the long delays involved when the furniture was handled by the railroads, and this feeling was intensified when the merchandise arrived, as it did sometimes, in bad condition.

To meet this situation and to make a direct-to-you proposition, the company finally decided to install a motor truck. In this action it adopted an entirely new policy, since it not only intended to use the vehicle for the work which its horses and wagons had been doing, but to substitute it for railway transportation. Although entering upon a situation possessed of all the uncertainties which attend any pioneer undertaking, the officials of the company had the courage of their convictions, and happily have found every expectation in that direction fully realized.

The vehicle purchased was a 3000-pound Mais, made by the Mais Motor Truck Company, Indianapolis, Ind., fitted with a 24 horsepower, four-cylinder engine, at a cost of $3200. This has been used in both local and country deliveries, and in the latter connection frequently has hauled furniture as far away from the store as 40 miles. Officers of the company are extremely enthusiastic as to the results which have been obtained.

"It has replaced three teams and wagons, to put it at a very low estimate," states one of the officials. "That is, we had five double teams and wagons, and the truck has displaced three of them. And this is taking no account of the increase in our business in the meantime, nor of the fact that this truck has been hauling our freight for us, a work which formerly was done by an outside concern under contract. That, by the way, is an item worth noting. We formerly paid this freight hauling firm anywhere from $60 to $150 a month. Now this truck handles the work without any trouble and takes care of its regular deliveries at the same time. In point of efficiency and economy there is simply no comparison between the wagons and teams and the truck.

"Then there is its advertising value, which also is worth considering. It is pretty nice to be able to tell people that we can deliver to them at towns 30 and 40 miles away—lay the furniture right down in their homes, instead of having to crate it, haul it to the station, prepay freight, take the risk of breakage en route, and then tell the customer to go to the station when the goods finally arrive and haul them home himself. I am not saying it is an actual saving in point of money laid out, because I hardly think it is, but there is no comparison in the value of the service rendered, and of course that means more business.

"The people out in the little towns and in the country like to have the truck come to the house, too. It gives them a sense of importance, the gratification of which is an appreciable factor in bringing them to our store for their furniture. And this feeling isn't confined to the country, either. I have had people right here in town give us an order for a bill of goods on the express condition that we send the stuff out on the motor truck.

"For emergency service, as where the customer wants a large order, the truck again is in a class by itself. It will carry twice as much as a two-horse team can pull, and do it more easily. We can load it up as soon as the order is given, unless it happens to be out on a long trip, and have the stuff on its way almost before the customer can get home. And he appreciates that sort of service, of course."

The actual figures justify the company's enthusiasm concerning the mechanical transport—not this particular vehicle, necessarily, as the officer in question is careful to explain, but of any motor truck as compared with teams and wagons. A tabulated comparison of the cost of this 3000-pound Mais and the horse equipment it has replaced is presented elsewhere and shows a monthly saving of $265.60 in the delivery work alone, leaving out of the accounting the sum formerly paid for freight haulage—$60 to $150 a month. These figures need some explanation.

Gasoline is purchased under contract and costs about 13 cents a gallon. A gallon will run the machine nine miles, and its daily mileage, limited by a governor to a speed of 15 miles an hour, is about 40-45. Light oil, purchased by the barrel, costs approximately 40 cents a gallon, and about 10 gallons a month are required. Grease and heavy oil cost about $1.50 a month. The man who drives the machine gets $18 a week, as against $15 for the horse driver.

The set of tires with which the machine was originally equipped is guaranteed for 10,000 miles, and an entire new set costs $250. Based on the mileage above

ESTIMATE BASED ON DENHARD FIGURES.

Annual Cost of Three Teams.

Feed	$1095.00
Shoeing	144.00
Repairs	108.00
Drivers	2340.00
Helpers	1560.00
Depreciation	600.00
Interest	150.00
Total with horses	$5997.00

Annual Cost of Mais Truck.

Gasoline	$202.80
Oil	48.00
Grease	18.00
Tires and overhaul	240.00
Driver	936.00
Helper	520.00
Depreciation	640.00
Interest	160.00
Total with truck	$2764.80
Balance in favor of truck	$3232.20

stated, the tire cost is figured at about $10 a month. This depends upon whether or not the original set will outlive its guarantee period, and present indications are that, as a matter of fact, they probably will far exceed that mileage.

The company allows an estimated depreciation of $10 a month, but this does not represent its estimate of the difference between the price of a new car and that at which this machine would sell after being in use. If this figure be interpreted as in the nature of an allowance for repairs or an annual overhaul, it may be permitted to stand as such, but it must be assumed that the life of no truck can be adequately represented by an annual depreciation of 4 per cent. Most concerns place their estimate at 20 per cent. or over, figuring the life of the truck as five years, for instance, and considering anything beyond that as clear gain.

It will be conceded that the items for depreciation and interest are somewhat arbitrary in character, and this applies alike to the horse and motor equipment. Hardly any two concerns will agree as to the proper percentage to use with the former, and it is possible to find almost as much difference of opinion with reference to interest. If it be desired to eliminate these entirely from the discussion, let it be assumed that the three teams and the truck represent about the same investment, on which the same interest and depreciation may be figured, and that these items will balance. Certainly this will hold true if the freight charge be added to the horse figures, and it will be noted that the tables contain no reference to the cost of crating furniture to be shipped by railroad, which also has been eliminated by the use of the truck.

The two tables herewith merely set forth the situation from two slightly differing viewpoints. One contains the figures as submitted by the Denhard Company with the substitution of the word "overhaul" for "depreciation," and the other, that giving the annual cost, is based on these figures with an estimate of 20 per cent. for depreciation on both truck and horses and an interest charge of 5 per cent. on the estimated investment.

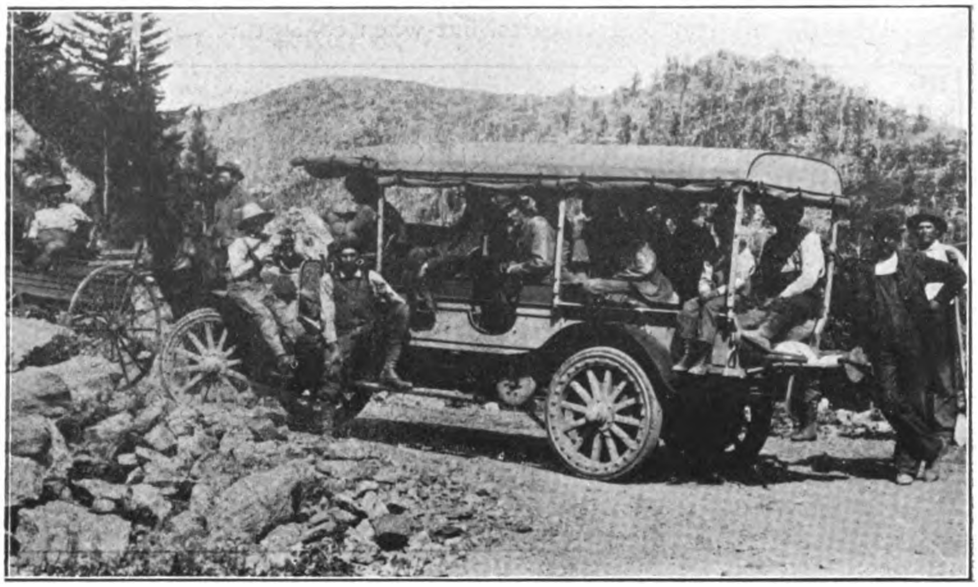
The Denhard figures show a monthly saving of $265.60, without including the freight haulage and crating. This would give an annual balance of $3187.20 —almost enough to purchase a new truck. The other table gives a slightly different result, the double teams with their wagons and harnesses being estimated at $1000 each, so as to bring their total value approximately that of the truck. If it be assumed that horses and wagons can be purchased for less money, the showing cannot be such as to effect the economy represented by the motor vehicle in any marked degree.

So well pleased is the Denhard company that within a short time it expects to replace the other two teams with a lighter truck, which will divide some of the work now being done by this vehicle and will make it easier for both. The plan is to allow the larger machine to do the long hauling and keep the lighter one for the city deliveries. "We cannot afford to use teams on the showing made by this truck," is the manner in which the company sums up the situation.

FEDERAL UNDERTAKES SEVERE TASK.

Operates as Motor Stage and Mail Wagon Over Winding Road at High Altitude.

A few months ago J. W. West of Idaho Springs, Col., purchased a one-ton Federal truck from W. W. Barnett, Denver agent for the Federal Motor Truck Company, Detroit. It was put into service as a motor stage and mail wagon, running from Idaho Springs to Alice, a distance of 11 miles. During the first three months of service it had not cost the owner one cent for repairs.



One-Ton Federal Truck Employed by J. W. West in Operating a Motor Stage Line Between Idaho and Alice, Col.

Some idea of the grades the vehicle is called upon to negotiate may be gained from the fact that the gradometer registers a pitch of 20 to 25 per cent. in places. The road twists and turns over a very rough course that formerly was used only as a trail. The car makes two trips a day, carrying mostly miners to the silver mines in that region.

The chassis is a regulation model D Federal, and is equipped with a combination body, having three cross seats which will accommodate nine passengers, and about four square feet of space in the rear for baggage and mail. Mr. West declares that although other dealers in Denver did not care to undertake the installation, the Federal has never missed a trip.

SUGGESTIONS FOR STARTING COLD MOTORS.

OPERATORS of commercial vehicles whose experience with the internal combustion engine has been limited to driving in warm weather, are encountering the same trouble in starting as drivers of the pleasure automobile. While difficulty was met last winter, there is even more this year owing to the heavier grade of fuel that is being marketed.

For the benefit of those not familiar with the principles involved in carburetion it is explained that the carburetor combines a certain amount of vapor with air and that the combination is termed the mixture. This is burned or exploded and the rapidity of the explosion depends largely upon the proper proportions of vapor and air. Briefly stated, a mixture having too much air is termed lean and burns slowly, while one heavily impregnated with vapor is said to be rich and tends to ignite more quickly.

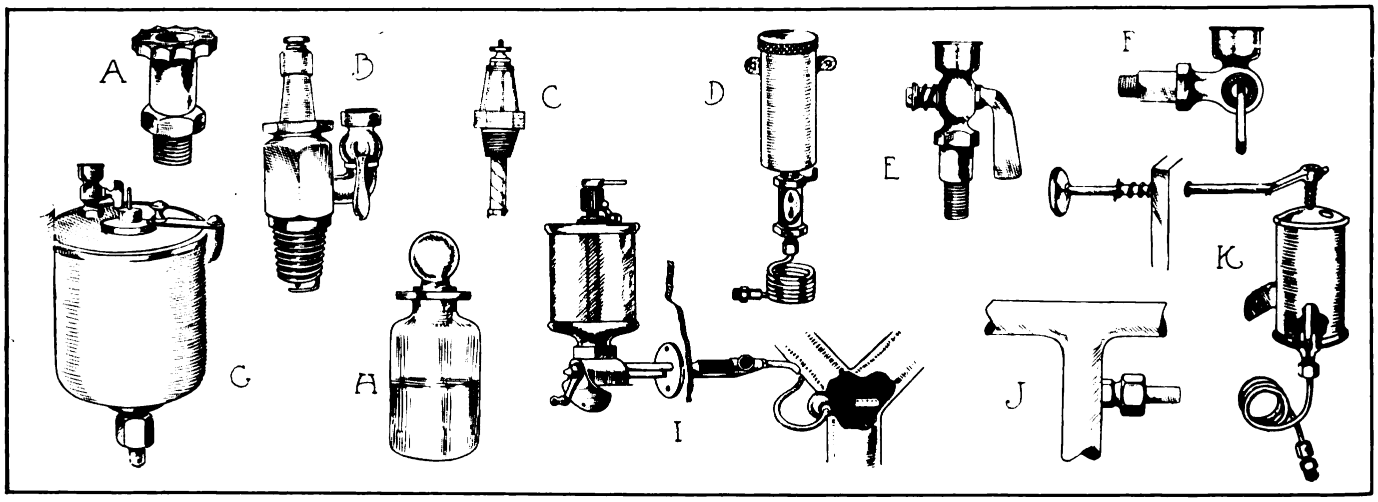
Rich and Lean Mixtures.

Gasoline, or to be more exact, motor fuel, evaporates readily in ordinary temperatures, but when cold the amount of vapor given off will be affected accordingly. It follows, therefore, that a carburetor set for a mixture of proper value in warm weather will, when cold, produce a lean mixture due to the lack of vapor, and starting is rendered more difficult. Even if the vaporizer does perform its function properly the mixture may condense in the intake manifold because of the excessive cold encountered.

While it would appear that the remedy was to increase the amount of fuel in proportion to the air, it must be taken into consideration that the mixture would not be of proper value at higher engine speeds if it were made excessively rich for starting purposes. To overcome this trouble carburetor manufacturers incorporate means for restricting the air or increasing the fuel, or both. These devices attain similar results to those secured by flooding or priming and closing the butterfly air valve, an operation with which most drivers are familiar.

When it is so cold that the engine cannot be started by utilizing these appliances, it will become necessary to employ some means of raising the temperature of the motor until it becomes warm through operation. The most simple method is by priming or injecting fuel into the combustion chambers through the petcocks and restricting the air until the motor is warm enough to run on the normal mixture. As the present fuel is heavy a good starting solution may be prepared by using a 25 per cent. mixture of sulphuric ether and gasoline. It should be carried in a bottle having a ground glass stopper as ether is extremely volatile and evaporates readily.

If the engine is not equipped with petcocks they may be fitted to the exhaust valve caps, or if this is not possible a spark plug having an integral priming cup may be employed. A priming cup fitted to the intake manifold facilitates starting as the fuel is sprayed over the walls of the pipe and makes for a rich mixture. Ether introduced into the carburetor through a priming cup, also aids vaporization. In priming the cylinders should not be flooded.



Priming Devices Making for Easy Starting of Motor in Cold Weather: A, Morgan Priming Cup; B, All-In-One Plug; C, Stallt Plug Heated by Electricity and Utilized in Intake Manifold; D, Nelson Sight Feed Primer; E, Conventional Type of Priming Cup; F, Design for Horizontal Cylinders; G, Priming Cup on Carburetor; H, Ether Should Be Carried in Bottle Having Ground Glass Stopper; I, Buckeye Sure Starter; J, Tapping Intake Manifold for Priming; K, Fowler Self-Closing Primer.

Raising Temperature.

If the car be kept in an unheated building, and the weather be very cold, starting after priming will be made more easy by heating the carburetor and intake pipe. Cover the vaporizer with a rubber cloth and pour the contents of a kettle of hot water over these members. This will prevent condensation of the mixture. Often after priming the motor will explode several times, then stop, necessitating a repetition of the work until the cylinders are warm.

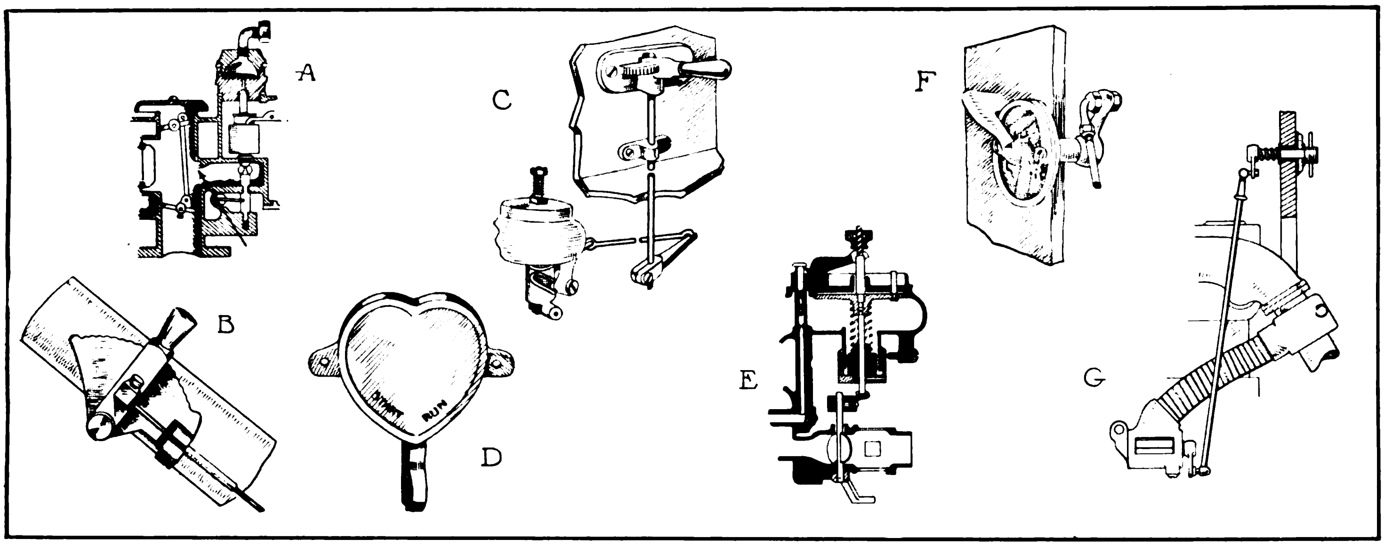
There are a number of priming devices being marketed and several of these are shown in the accompanying illustrations. The principle involved is that of conveying gasoline or a highly volatile fuel to the intake manifold, creating a rich and easily exploded mixture when the motor is cranked. Some designs include a pipe leading from the exhaust manifold so

that after the first explosion the fuel is heated. Others provide means for adjusting the air as well as the flow of the fluid. Being operated from the seat, the driver is saved the trouble of flooding the carburetor and shutting off the supply of air in starting.

Dash Controls.

The carburetor manufacturers are cognizant of the fact that fuel has been growing heavier and have made provision accordingly. Many of the leading designs incorporate dash controls which not only permit of adjusting the mixture from the seat, but restrict the air and enrich the mixture when starting. Others provide auxiliary means for raising the level of the fuel in the spraying nozzle.

Clean fuel, perfectly free from water, and a good spark are important factors in starting a cold motor. It is imperative that the dry cells or storage battery be in good condition and that the spark take place as near dead centre or at the beginning of the firing stroke, as is possible. If the spark be too late and the mixture thin the explosion will be weak. As the majority of carburetors are equipped with means for taking in auxiliary air above certain motor speeds, a few suggestions concerning starting, as well as extracts from the instructions of the maker, will be of value to the driver unfamiliar with cold weather carburetion.



Dash Controls Utilized for Enriching the Mixture and Priming Components of Carburetors: A, Rayfield Construction Includes a Dam Which Is Flooded with Fuel; B, Miller Utilizes Steering Post Control; C, One of the Stromberg Controls for Restricting Air; D, Schebler Dash Device; E, Stromberg Closes Both Fixed and Auxiliary Air Inlets; F, Rayfield Starting Control on Dash; G, Holley Temperature Regulator and Strangler.

Rayfield.

The Findeisen & Kropf Manufacturing Company, Chicago, maker of the Rayfield, advises opening the throttle about one-quarter. More will augment starting troubles. Each Rayfield is provided with a dash adjustment the actuation of which lifts the needle valve, creating a rich mixture. In severe cold weather it is advisable to flood the carburetor by using the priming attachment which fills a dam with fuel. When the motor is cranked the fuel is drawn into the cylinders in the form of a heavy mixture. After the motor has become warm the dash lever should be returned to normal position.

Stromberg.

The Stromberg, made by the Stromberg Motor Devices Company, Chicago, utilizes a combination starting device, dash controlled. When the operating handle is moved to "start," the fixed air inlet passage is closed by a valve and the auxiliary member is also held on its seat. This results in the piston drawing in a very rich mixture. Like the Rayfield, the Stromberg uses heated air from the exhaust, but this serves only to heat the mixture after the first explosions.

Schebler.

Wheeler & Schebler, Indianapolis, Ind., maker of the Schebler carburetors, recommends for models O and L that the mixture at low speed be made slightly more rich in cold weather owing to the heavy grade of fuel. This is obtained by opening the needle valve member. Dash controls are provided with both models and the auxiliary air intake of the O is closed for starting purposes. This design is equipped with means for taking hot air from the motor and it is recommended that the lever be moved to the full open position in winter. The model L is adjustable from the dash, in that moving the lever to "start" creates a rich mixture by eliminating the air. Means for priming are incorporated in all Schebler types.

Holley.

In the Holley carburetor, made by the Holley Bros. Company, Detroit, a strangling device is employed in conjunction with a temperature regulator, the object being to restrict the amount of air and to enrich the mixture. It comprises a flexible metal tube having a scoop at one end and being secured to the exhaust pipe. The other end is fastened to the air intake of the carburetor and is provided with a shutter member, the opening and closing of which is controlled by a handle on the dash. When the valve is closed the mixture is enriched and the first few explosions are productive of heated air. After starting the amount of air is adjusted as required.

C R G.

A priming device creating a fine spray in the intake manifold is utilized in connection with the C R G carburetor, made by the C R G Manufacturing Company, Saugus, Mass. If a pressure feed is employed the main line of supply is tapped and the pipe led to the intake manifold, where the spraying effect is secured through opening a valve. With the gravity feed pressure is obtained for spraying by a small hand pump mounted upon the dash.

Newcomb.

An auxiliary nozzle is used for starting in very cold weather in the Newcomb carburetor, manufactured by the Holtzer-Cabot Electric Company, Brookline, Mass. It is brought into action by rocking the throttle valve back past the closed position when the suction of the piston draws a spray into the cylinders. In severe cold weather the device is assisted by depressing the float, which causes the fuel to overflow into a plunger chamber, further enriching the mixture. The Newcomb has a dash adjustment for starting and operating.

Breeze.

The Breeze Carburetor Company, Newark, N. J., maker of the Breeze, lays great stress upon the Col-Mac exhaust hood for facilitating carburetion, stating that by it air free from atmospheric moisture is taken into the vaporizer and that after the first explosion or so the air is dry and more perfect carburetion is possible. It is also pointed out that hot air is supplied in a few seconds, as it requires but a short time to heat the exhaust pipe.

TRUCK SIZE IN NEW YORK.

Highway Commission Now Considering Bill and Limit Weight Similar to Massachusetts Suggestion.

A bill somewhat similar to the one introduced in the Massachusetts legislature a year ago and referred to the legislature of 1913, is being considered by the highway commission of New York State. The proposition is to limit the size of motor trucks to be used on the state highways, the only roads to which its provisions will not apply being state and county highways having a concrete roadbed of six inches or more in thickness with brick street surface. The New York commission is at present divided between two propositions, set forth as follows:

First Proposition.

It shall be unlawful for any person, firm, association or corporation to draw or propel, or cause to be drawn or propelled, over any state or county highway which has been or may hereafter be improved by the state, or state and county, any vehicle the weight of which shall exceed, in combined weight of load and vehicle, as related to the width of tire, the weight per width as given in the following table.

Second Proposition.

The following regulations to apply only to various forms of macadam and gravel highways as built by the state, or state and county. Combined weight of load and vehicle to be limited to a maximum of 400 pounds per inch of width of tire carrying the same. Under this regulation four-wheeled vehicles carrying evenly distributed loads might be loaded to the following:

Vehicles with	Maximum load, pounds. one axle*	both axles†
1-inch tires	....	1,600
1.5-inch tires	1200	....
2-inch tires	1600	3,200
2.5-inch tires	2000	....
3-inch tires	2400	4,800
4-inch tires	3200	6,400
5-inch tires	4000	8,000
6-inch tires	4800	9,600
7-inch tires	5600	11,300
8-inch tires	6400	12,800
9-inch tires	7200	14,400
10-inch tires	8000	16,000

*First proposition; †second proposition.

EFFECTS LARGE SAVING.

Saurer Truck in Arizona Mining Section Cuts Haulage Expense More Than Third.

Recently the Arizona Southwestern Copper Company installed, as an experiment, a 6.5-ton Saurer motor truck, made by the International Motors Company, New York City. The car has been operated between Yucca and Copperville, Ariz., a haul of 27 miles, and a careful observation was kept of its performances. The results far exceeded expectations, the cost a ton for the haul being reduced from $15 to less than $5. Numerous deep sand washes must be crossed and seven miles of grade from 10 to 18 degrees must be negotiated, but the truck has proved itself equal to the occasion. The following operating figures indicate the cost of each trip:

Gasoline, 19 gallons, @ 30 cents	$5.70
Oil, five quarts, @ 20 cents	1.00
Grease, one pound	.12
Driver, 1.5 days, @ $4	6.00
Total visible expense	$12.82
Interest on investment at 6 per cent. and insurance for 1.5 days	2.11
Depreciation at 10 per cent	2.67
Repairs	2.25
Tires	2.83
Average cost a trip for upkeep and expense	$22.68
Cost a ton a trip	$4.53
Former cost a ton	$15.00
Showing a saving of	$10.46

The saving to the company on each trip over that of the wagon haul is $52.30. With the completion of the company's new mill, permitting haulage from the mill to the railroad, the truck will show a much greater economy, as practically all the transporting will be on a descending grade.

Manager F. E. Grable of the Universal Truck Company, Boston, distributor of the Universal trucks, made by the Universal Motor Truck Company, Detroit, recently gave a demonstration of the utility of the vehicle to a furniture dealer in Waltham, Mass., when the car left the Boston garage at 4:20 in the morning, reached Waltham at 5:25 and left at 10, with a three-ton load of furniture, including piano, for South Berwick, Me. It arrived there at 8 in the evening, left at 11 the same night and reached Waltham at 8:25 the following morning. The distance travelled was 201 miles and 33.5 gallons of gasoline and five quarts of oil were used. The machine averaged 10.5 miles an hour and completed a very satisfactory trip.

CORRESPONDENCE WITH THE READER.

Priming Intake Manifold.

(22)—I am driving a Model T Ford delivery car and am experiencing considerable trouble in starting after the engine has become cold. There are no petcocks on the motor and I wish to fit an attachment so that the engine may be primed for starting. Can you give me any suggestions?

OWNER-DRIVER.

Cambridge, Mass., Dec. 5.

There are a number of priming devices suitable to the car mentioned. A spark plug having an integral cup is shown elsewhere. This is made by the Frontier Specialty Company, Buffalo, N. Y., and is on sale at the majority of supply houses. Various priming devices for conveying fuel to the intake manifold also are described in this issue.

One may be made, however, and in an accompanying illustration the arrangement is depicted. The material required consists of an oil cup of the sight feed type and having a snap lever for controlling the flow of the fluid. These members hold from .625 to 18 ounces. One having a capacity of a couple of ounces would serve.

It is secured to the dash by straps or other suitable means and a hole is bored in the dash to allow the copper tube leading from the cup to the intake manifold to pass. The intake manifold is drilled and tapped to take a connector to which is secured the tubing. A reducer will be necessary to connect the small tubing to the oil cup member.

The operation of the device is very simple. The snap lever is moved to allow the fuel to flow and the amount may be regulated by the knurled screw with which each cup is provided. It could be so set that a few drops would flow or a small stream would be secured. In very cold weather the fuel could be made more volatile by employing 25 per cent. of sulphuric ether. The material can be secured at any supply house and the cost will be moderate. It is advisable to employ annealed tubing.

Magneto Not Faulty.

(23)—We employ a converted pleasure car and recently my driver got stalled in the country. He 'phoned in that he could not start the engine on the battery or the magneto. The magneto is a Splitdorf and was overhauled a few weeks previous to the trouble. We sent out a man from a garage who started the motor after a little work. He reported that the magneto was to blame, stating that the trouble was in the circuit breaker, but would not explain how to remedy this if it occurred again. Our driver is a good operator and understands ignition fairly well, but reported that although the batteries were good he could not get a spark. Could you advise me as to the trouble?

W. L. R.

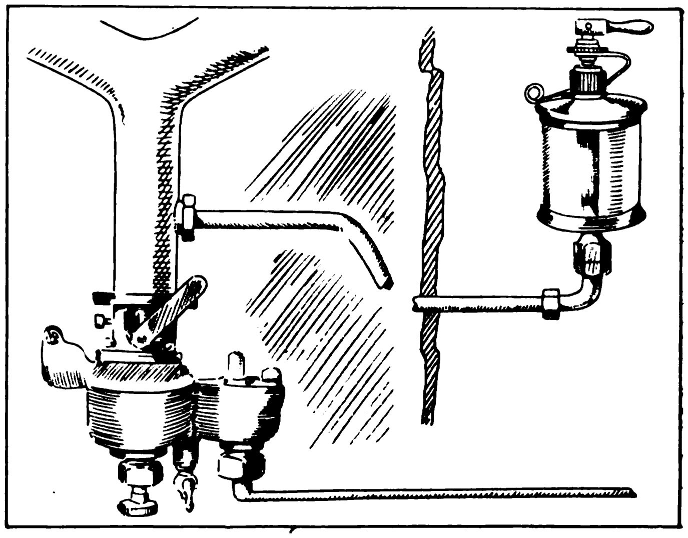
Torrington, Conn., Dec. 4.

It would appear from the fact that the repairman remedied the trouble easily the fault was due more to the workman who overhauled the magneto than to the instrument itself. It is very possible from the meager description given that in replacing the breaker box the repairman who cleaned the instrument did not replace and lock the cover properly, and that it jarred loose, preventing contact of the brushes on the cam.

With the magneto referred to, when the motor is started on the batteries, the current is led to the circuit breaker by a wire connected to a terminal on the brass cover. This terminal is fitted on the inside with a brush or brushes making contact with the cam which makes and breaks the primary current in a manner similar to the timer or commutator employed with the coil and battery system of ignition.

The battery or low-tension current is interrupted by the circuit breaker and led to the coil, where it is built-up into a high-tension current. It flows back to the distributor of the magneto, so-called because it distributes the induced current to the proper cylinder.

If the wire leading from the battery to the terminal above referred to were broken or the brush were not making proper contact, it would be impossible for the current to reach the circuit breaker. The Splitdorf magneto is easily disassembled; that is, the only parts that require any attention, and the cover to the circuit breaker is retained by two small nuts. The Splitdorf Electrical Company, Newark, N. J., or the agent of the car, will supply an instruction book which will enable the operator to remedy troubles of a similar nature.



Method of Fitting Device for Priming Intake Manifold from the Dash. Illustrating the Col-Mac Utilized for Conveying Heated Air to the Carburetor and the Connections.

Battery Output in Winter.

(24)—Am I correct in understanding that a storage battery is affected by the cold and that you do not get as much current in the winter as in warm weather?

READER.

Kenosha, Wis., Dec. 15.

A storage battery is affected by the cold in that its output is impaired; that is, the voltage remains practically the same but the amperage is less. Therefore, it is advisable not to rely upon the cells giving as much service in the winter as in the summer.

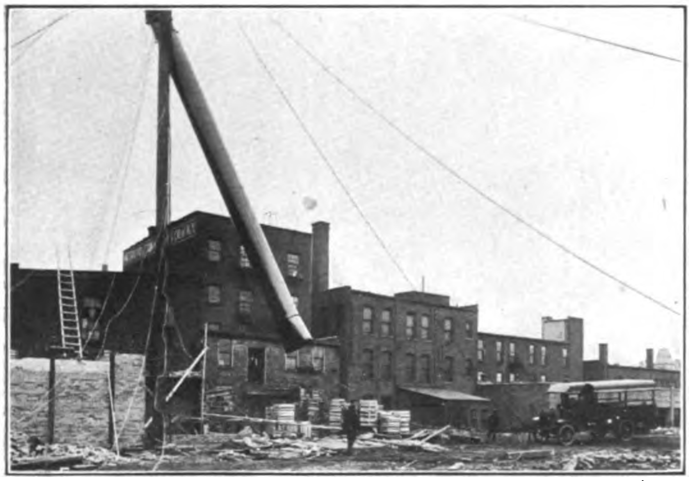
Commissioner Edwards of Salem, Mass., who has charge of the street cleaning department, will ask the aldermen to make an appropriation for 25 motor trucks to be used as garbage wagons, to take the place of the horse drawn vehicles now in service. Mr. Edwards has figures proving the economy of his recommendation.

WHITE PLACES STEEL CHIMNEY.

Three-Ton Truck Demonstrates Its Economy in Special Work of Time and Labor.

An example of the almost innumerable uses that can be made of a motor truck was seen a few days since in Cleveland, O., where a White three-ton truck was utilized to place a very large sheet steel chimney. The big tube was to be installed on a base 12 feet above the ground at the boiler house of the Belle-Vernon-Mapes Dairy Company at Cleveland, and its great length and diameter made it extremely difficult to handle. The weight was about 4500 pounds and it was necessary to lift it above the brick furnace and then lower it into position.

A huge timber was utilized as a derrick and after the tackle had been rigged this was raised upright beside the furnace and supported by guys. A sling was then carried about the stack and to this the lower end of the tackle was made fast. The wire rope was carried through a block at the base of the derrick and made fast to the truck, and when all was in readiness the machine was started and lifted the stack to a height where it could be swung and lowered into place. The work was quickly done when the preparations had been made, and the truck was needed but a comparatively brief period. The economy of the truck in saving labor and time appealed very strongly to the men doing the work, and they were of the opinion that machines could be used for hoisting purposes with as much success as for haulage.



Hoisting an 80-Foot Metal Stack into Place, 12 Feet Above the Ground, with a Three-Ton White Truck.

REOS IN CALIFORNIA.

Los Angeles Owners Report Satisfactory Service and Figures Indicate Economical Operation.

The 1500-pound Reo trucks, made by the Reo Motor Truck Company, Lansing, Mich., are put to many uses in various parts of the country. In Los Angeles, Cal., a large number of these vehicles are utilized, the performances of some of them being noteworthy. Carrying an overload that frequently amounts to 500 pounds, the little truck used by the Grande Fruit Company to deliver fresh fruit and other produce to widely separated stores in all parts of the city, covers scores of miles a day and the average daily operating expense does not exceed 50 cents.

Another truck that gives excellent service is a Reo owned by the Gibson market of West Pico street. Averaging between 60 and 70 miles each day, it covers this distance on three gallons of gasoline. The fact that the vehicle does not carry heavy loads accounts in part for this remarkable mileage record. A Reo machine in the service of the J. W. Hallman Hardware Company, carrying loads that vary from 1500 to 2000 pounds, averages between 12 and 13 miles on a gallon of gasoline and covers ordinarily 50 miles a day. These are fair samples of the service that these sturdy and economical little cars daily perform.

PIERCE-ARROW'S RECORD SERVICE.

Covers Over 19.000 Miles in Los Angeles on Original Set of Tires and Pleases Owner.

A remarkable record of service given by a five-ton Pierce-Arrow worm driven truck has just been received by J. B. Livesey of the truck department of the W. E. Bush Company, Los Angeles, Cal., distributor for the product of the Pierce-Arrow Motor Car Company, Buffalo, N. Y. The vehicle in question is owned by the Motor Transportation Company of Los Angeles. Since March it has travelled 19,054 miles and delivered 5450 tons of freight. In performing this work it has averaged 5.2 miles to a gallon of gasoline and 261 miles to a gallon of cylinder oil.

During the last four months the truck has been in service 20 hours a day. In September it covered an average of 127.6 miles a day or 3822 miles for the month. In commenting upon this performance the officials of the Motor Transportation Company write as follows: "We wish to say that the truck travelled the entire distance mentioned on the original set of tires, which we think, with the other data taken into consideration, makes a record that would give food for thought and by which the Pierce-Arrow worm driven truck speaks for itself."

The Edison Storage Battery Company, Orange, N. J., has recently distributed to electric vehicle engineers and others having use for them handsome leather covered binders containing a series of data sheets relating to the Edison batteries. The 41 sheets contained in the binder are to be supplemented from time to time by similar information, and provision is made for its preservation and use. The binder and data are a decidedly useful addition to the reference library of any person having to do with Edison batteries, being compiled with extreme care and containing facts that will frequently serve an excellent purpose.

THE A B C OF MOTOR TRUCK IGNITION.

Part V—Outlining the Various Systems Utilized with the Commercial Gasoline Vehicle, Their Components and Application in Practise—Wiring Single and Multiple Coils with Dry Cells, Storage Batteries or Mechanical Generator.

By C. P. Shattuck.

IN THE previous installment the primary and secondary circuits were outlined, and the method of converting the low-tension current derived from the battery into high-tension for igniting the mixture was explained. It also was shown that the function of the timer or commutator was to break the flow of the primary or battery circuit at the proper instant and that the spark took place in the combustion chamber approximately at the same time.

As the care and maintenance of the ignition system is an important factor in commercial car service, and as previously explained it is essential that the operator be familiar with the principles of ignition, it will prove of value to consider the installation of the simpler form—the chemical battery and induction coil. By familiarizing himself with the operation of the components of this type the driver will be enabled to make repairs while on the road and the knowledge also will form a basis for the study of the mechanical generator, or magneto. The practical experience acquired will facilitate the work of the overhaul.

Considering first the application of a high-tension system to a single-cylinder motor: The components required comprise a single-unit induction coil, a source of current (dry cells, for example), a spark plug, commutator, switch and high and low-tension wires. The importance of high grade wiring, properly attached terminals and good connections has been explained. Assume that a set of six dry cells is to be utilized as the source of current, and that they are to be wired or connected in series. When so connected there will be two free ends or two terminals, one being the carbon, or positive +, and the other the negative —.

It will be remembered that in order for electricity to flow a path or circuit must be completed, and it is assumed that the current leaves the carbon or positive pole of the battery and returns, or re-enters the cell by the way of the zinc or negative. By referring to Fig. 21 it will be noted that a wire is secured to the zinc terminal of the battery and led to the ground. Any metal part of the chassis may be employed as the ground, and usually the wire is secured to the frame. This completes one side of the primary circuit.

The second lead from the cells, the positive, is attached to the primary or battery terminal on the coil. To break or open the circuit and thereby prevent the passing of the current through the circuit a switch is utilized and it may be attached to and made a part of the coil, or placed on the dash or in some other convenient location.

If the two leads from the cells were connected current would flow, but if a switch were incorporated in the line and opened, the flow would be checked or stopped, to be re-established when the switch lever was moved to what is designated the "on" or "battery" position. When it is desired to stop the operation of the motor, the lever is moved to the "off" position, which breaks the circuit.

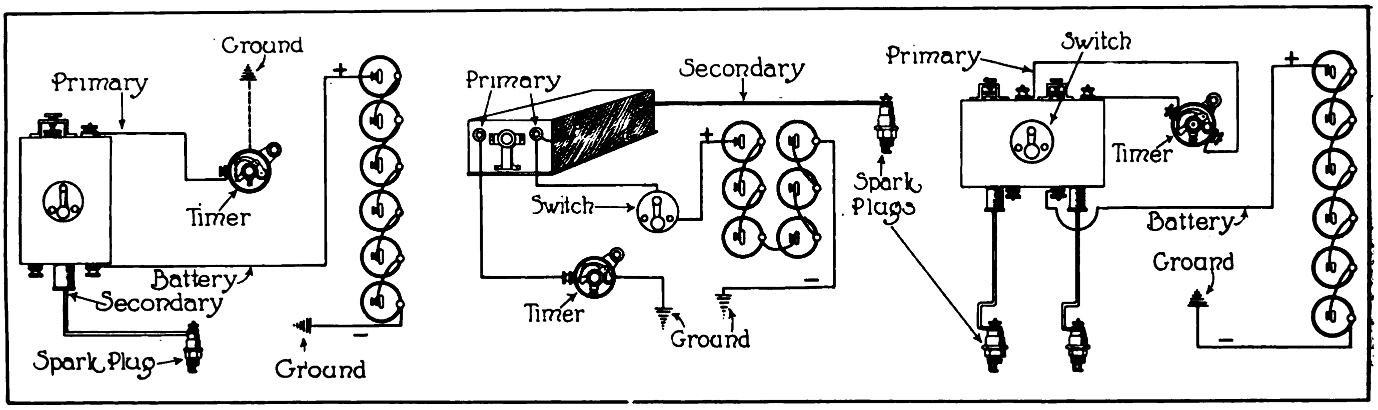


Fig. 21—Depicting Wiring Plan for Single and Two-Cylinder Ignition with Dry Cells as a Source of Current: At Left, Vibrating Type of Coil Having Three External Connections; Centre, Box Design with Two Primary and Two Secondary Terminals; At Right, Primary and Secondary Connections of Two-Cylinder Motor.

As it would not be practical to utilize the coil or dash switch for breaking the primary circuit when the battery current is strengthened, the timer is employed for this purpose. This is in reality a switch, in that it establishes and breaks the primary circuit at the instant the mixture should be ignited by the flame at the gap of the spark plug.

It was shown at Fig. 20 that a metal member or block is imbedded in non-insulating material, usually fibre, and that a rotating metal roller makes contact at a certain degree of its rotation. When the roller is in contact with the fibre the primary circuit is not established, although the switch on the coil may be closed. Upon the roller touching the metal block, the

circuit is completed, and as shown at Fig. 21 (assuming that the coil switch is closed) the primary or battery circuit is completed and current begins to flow.

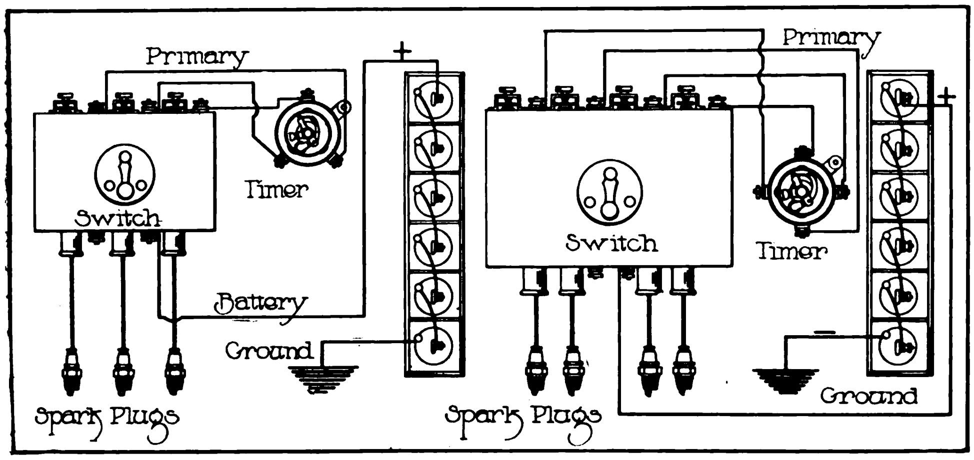


Fig. 22—Illustrating Wiring Plans for Three and Four-Unit Coils Utilized with Three and Four-Cylinder Motors.

It will be noted that a wire leads from the insulated terminal on the timer and is attached to the top of the coil. With the circuit completed current is flowing from the batteries to the coil, the core of which is converted into an electric magnet attracting the vibrator spring to it and thereby causing the platinum contact points to separate and thus break the circuit. This is denoted by a buzzing noise and takes place when the metal members of the timer are in contact, but ceases when the connection is broken either at the timer or by means of the switch. It is at the instant of breaking that the secondary current is created.

The high-tension current is conveyed through a heavily insulated cable to the spark plug, where it jumps the gap, creating a flame, and as the base of the plug or that part screwed into the cylinder is of metal, the current continues to flow through the motor, frame and wire back to its source. It should be borne in mind that a path or circuit must be established for the secondary as well as the primary currents.

Wiring Box Type of Coils.

On the box type of coil shown at Fig. 21 there are four terminals, two primary and two secondary. It will be noted that one primary and one secondary are coupled, and that a wire is led to the centre terminal of the switch. One lead from the dry cells is grounded while the other is secured to the terminal of the battery. From the primary terminal of the coil is led a wire to the insulated terminals of the timer.

Two-Cylinder Units.

The wiring of a two-cylinder motor may be accomplished successfully by applying the same principle as with the single-unit, the only difference being that two cylinders are to be fired instead of one. The simplicity of the wiring plan is shown at the right of Fig. 21 and it will be seen that one side of the battery circuit is grounded as with the single-unit system. Two coils are utilized and conventional practise places them side by side in a single casing, or coil box as it is termed.

Each unit acts independently of the other and as indicated in the drawing a separate cable is utilized to convey the high-tension current to the spark plug. As there are two cylinders, it follows that each will require an independent spark so the timer is provided with two metal blocks, the terminals of which are connected by wire to the respective binding posts on the coils. The operation of the switch is similar to that of the single-unit coil except that means are provided for breaking simultaneously the primary current to both.

It will be noted in the wiring plan that a wire is led from one terminal of the timer to the right hand binding post of the coil, which for convenience will be designated as the No. 1. The secondary wire from this coil is led to the spark plug of the No. 1 or first cylinder to be fired. The second or remaining lead from the timer is secured to the No. 2 coil, the cable of which leads to the spark plug of the second cylinder. As the roller of the timer rotates it will make contact first with the No. 1 block, firing the first cylinder, then with the second terminal of the commutator, causing a spark in the combustion chamber of the second cylinder. This is repeated so long as a source of current is provided and the components of the system perform their function.

Three and Four Units.

Any number of units may be utilized, depending upon the number of cylinders. At Fig. 22 are shown the wiring diagrams of three and four-cylinder units, and with dry cells as a source of current. It will be seen that the timer is provided with terminals corresponding to the number of units. All of the wiring

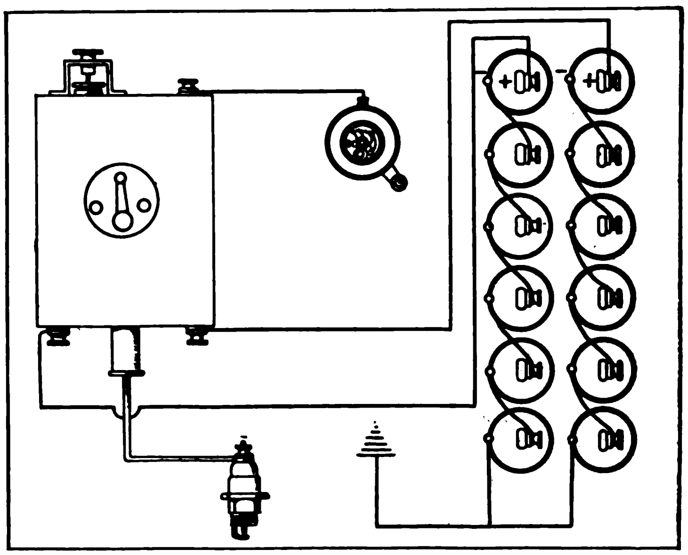


Fig. 23—Showing Wiring Plan for Two Sets of Dry Cells Controlled by a Single Switch.

plans presented and discussed make use of but one source of current, a set of six dry cells, but two independent groups may be employed, or a chemical and

mechanical generator may be utilized, as will be explained.

The majority of coils, be they single or multiple-units, are provided with a two-throw switch; that is, they are so arranged that two sets of batteries may be used. At Fig. 23 are shown two groups of cells and the method of wiring, as well as the independent connections to the switch. The batteries are wired in series and it will be seen that the individual leads from the zinc or negative terminals are both led to the ground or frame. To economize in wire, the insulation may be removed from one lead and the other spliced to the bare wire, after which it should be taped.

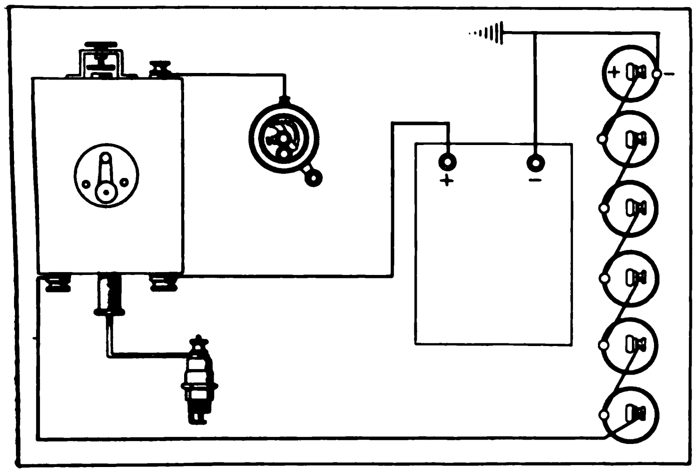


Fig. 24—Outlining Wiring with Dry Cells and Storage Battery, Showing How Polarity Should Be Observed.

As there are two sets of cells it is evident that two carbon or positive terminals are free and these are connected by wire to the right and left hand battery terminals of the coil box as illustrated in the drawing. Each of these terminals is connected by wire inside the coil box to the terminals on the switch, which are indicated in the drawing by small circles. The top of the switch lever is also connected to the primary circuit of the coil.

Normally a path is not established when the lever is in a vertical position as shown in the drawing, but upon its being moved to the right, the circuit is established as the lever, being of metal, forms a connection. Current will flow, provided proper contact is made at the timer, from the right hand set of batteries. Upon moving the switch lever to the left the other or reserve set of cells is brought into service and the first named batteries are cut out.

Utilizing Cells and Storage Battery.

The source of current may not always be dry cells, as a storage battery may be utilized, or both. Wiring dry cells in two sets in series is a simple matter as the novice is guided by the positive and negative terminals, but when a storage battery is to be employed with dry cells for reserve or vice versa, it is imperative that the polarity be observed. The storage battery is usually marked, the negative being denoted by — and the positive by +, and in wiring these members care must be taken or the cells will become exhausted through short circuits.

At Fig. 24 is depicted the wiring of a set of six dry cells and a storage battery. It will be noted that the wire leading from the negative pole of the storage member is spliced to the negative lead from the dry cells, then continued and grounded. The positive lead from the storage is connected to the right hand battery terminal on the coil while that from the dry cells is secured to the left hand member. By utilizing the switch as above described either source of current may be employed.

Mention has been made of the mechanical generator. There are several types manufactured and that depicted at Fig. 25 develops a low-tension current, the voltage of which is approximately the same as a set of six dry cells or the conventional type of ignition storage battery. It may be employed with dry cells, in which event the latter are utilized for starting the motor, then cut out and the generator employed for supplying the current.

Referring once more to Fig. 25, it will be seen that there are two poles or terminals on the magneto, a negative and positive, and one of these is grounded. The other is led to one side of the switch. When the switch lever is moved to the left and the circuit closed, current flows from the generator in practically the same manner as it would from a battery. The drawing shows a set of four dry cells, which in this instance is utilized for starting. The arrangement of the timer and secondary wire is the same as with the other systems, but it will be noted that in this instance the left hand lower terminal on the coil is utilized for making the desired connection with the commutator. With a generator of the type outlined, the electricity is led to the coil and built up into a high-tension current in

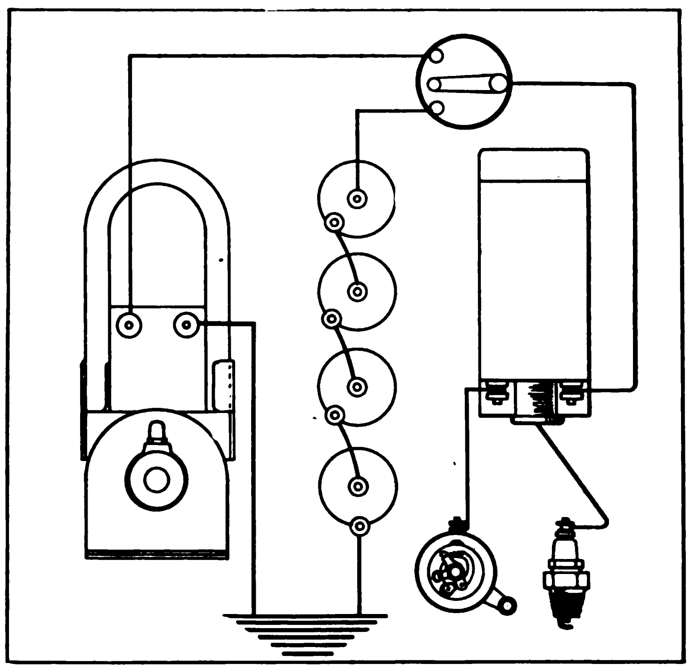


Fig. 25—A Mechanical Generator May Be Utilized with Dry Cells or a Storage Battery, Providing Two Separate Sources of Current.

the same manner as when the source of current is chemically derived.

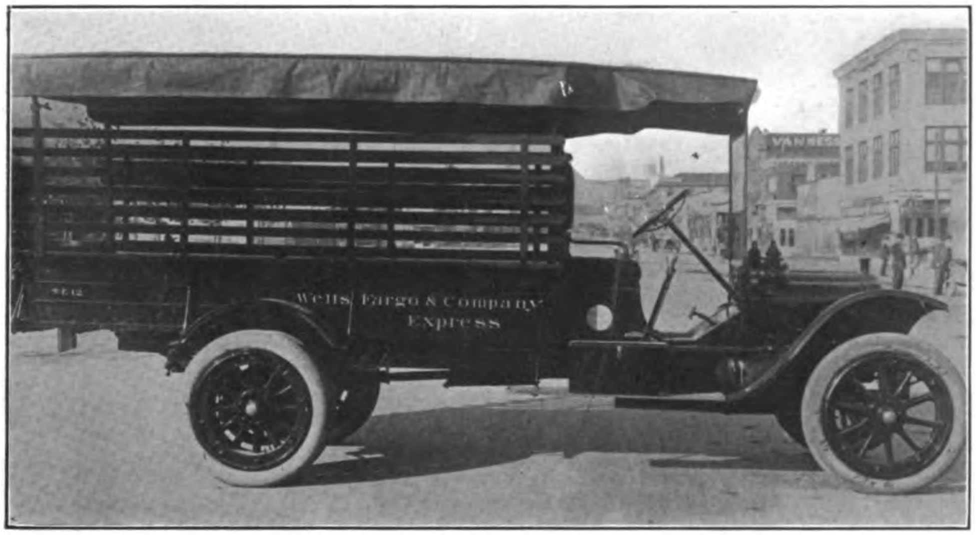
(To Be Continued.)

WHITES FOR EXPRESS COMPANY.

Wells Fargo Company in San Francisco Receives First Machine on Recent Order.

An accompanying illustration presents the White 1.5-ton truck, made by the White Company, Cleveland, O., which is the first to be delivered to the Wells Fargo Express Company, San Francisco, Cal., on a recent order for four of these vehicles. Inasmuch as the express companies of the country have been experimenting with several types of vehicles before making decision in the matter of ordering in quantities, it must be accepted as demonstrated that the White trucks are able to satisfy the requirements of this concern in this particular field.

The body is specially designed for the work it is to perform, being fitted with an extension top to provide for carrying larger loads should occasion require. The location of the package compartment is with special reference to weight distribution. The pneumatic tires, single in front and dual in the rear, are stock equipment with this size of White vehicles.



One of a Fleet of 1.5-Ton Whites Recently Ordered by Wells Fargo Express Company.

PACKARDS SOLVE DELIVERY PROBLEM.

Worcester Concern Extends Its Service to Include Over Sixty Towns and Secures New Business.

The Denholm & McKay Company, Worcester, Mass., which operates the large dry goods business known as the Boston Store in that city, has just installed a new suburban automobile delivery service that is covering practically every city and town within a radius of 25 miles. The company, by the use of a fleet of Packard trucks, made by the Packard Motor Car Company, Detroit, has greatly extended its delivery zone and is giving twice-a-week service to over 60 towns, operating on a regular schedule. The innovation is not only a decided impetus to the trade of the Denholm & McKay Company, but enables the people in the towns served to send in mail or telephone orders and have their goods delivered at their doors in minimum time and without extra charge.

SAVES ON FERRY TOLLS.

Peerless in Milk Delivery Makes Important Reduction in Addition to Other Economies.

Owing to its ability to carry heavy loads over steep grades in much less time than horses, the five-ton Peerless truck, made by the Peerless Motor Car Company, Cleveland, O., and operated by the Howell Condensed Milk & Cream Company of Jersey City, N. J., is eliminating over $3000 a year in ferry tolls alone, in addition to all the usual savings that result from successful motor truck operation. Every night the company hauls a large quantity of milk from Jersey City to a point two miles in the interior of Staten Island. The truck makes two trips with 100 40-quart cans, each weighing 110 pounds.

The present route covers a run of eight miles from the distributing station in Jersey City to the Bergen Point ferry and another of two miles after reaching Staten Island, making a round trip of 20 miles, or 40 miles for the night's work. The ferry tolls are 35 cents for each passage or $1.40 a night. It was impossible for the teams which formerly did the work to take this route because they could not cover the 10 miles over steep grades fast enough to deliver the milk on time.

Two teams formerly left the distributing station and proceeded by way of the Erie railroad ferry to New York. The toll for this trip was $1 a team. Across Manhattan it was one mile to South Ferry and the ferry toll from South Ferry to Staten Island was $1.50 for each team. This amounted to $10 a night for two round trips for two teams as against $1.40 for the truck. As the motor vehicle works every night in the year the annual saving is $3139. The Howell company is also now running this truck in the daytime.

A new concern at Johnstown, Penn., of which Adam Trabold is the head, has begun the manufacture of commercial automobiles. Its first truck, which was sold to the Germania Brewing Company of Johnstown, is reported to have given good service and six more will be produced in the near future. It is Mr. Trabold's intention to build vehicles with capacity from one to five tons suited to any purpose or business. The one-ton trucks will have a 35-40 horsepower motor and 116-inch wheelbase.

NEW WATER-COOLED KELLY TRUCKS.

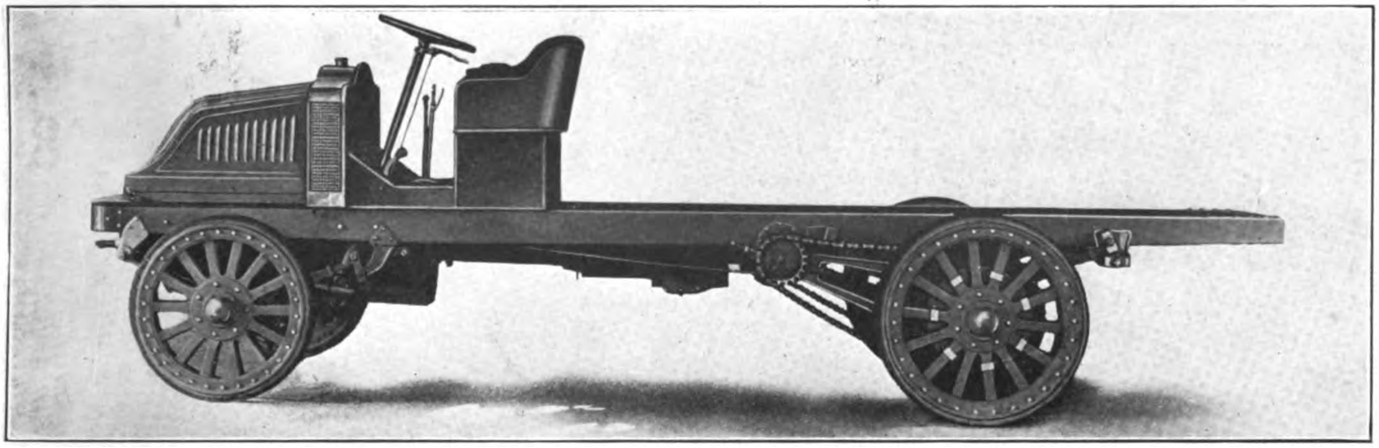
TWO new machines, both of the water-cooled motor type, have been announced by the Kelly-Springfield Motor Truck Company, Springfield, O., which has succeeded the Kelly Motor Truck Company. The original productions were vehicles with a motor cooled by air circulated about it by a blower system. The company has been given a new name and its capital has been greatly increased, and its facilities correspondingly developed. The statement is made by the company that it has all the advantages of a new concern with the experience of an old one, that with an engineering department of undoubted capacity and experience it is prepared to build what is believed to be the best vehicles in the country, and that with its enlarged plant it will have capacity to produce 1200 machines during 1913.

It is emphasized that it is not purposed to utilize tools or material that were used in the building of the old models. In every respect the machines will be new. It is also made clear that with its long experience the engineering department has learned what not to do in motor vehicle design and construction.

Aside from the transition from air to water cooling the company has made a very radical change in design, and that is in the construction of a chassis frame. Instead of endeavoring to secure rigidity, the frame is to be made as elastic as possible, so that there will not be a resistance from the members under road or load stress that will cause strain of parts or excessive thrust, with loosening of rivets, bolts and other connections. To the contrary the frame has been designed so it will yield to the tendencies to distortion, and yet will maintain the original form when relieved of such strains.

This construction will, it is maintained, give a vehicle that will have every quality that could be sought and will not be susceptible to the influences that are now regarded as productive of extreme deterioration. The frame is constructed of very heavy pressed steel channel section, and it has but three cross members, one at either end and the third in the centre. The mechanism is protected against the distortion by universal joints and swivelled connections, which will permit a very much greater range of movement than the machine could ever be subjected to.

The motor is installed in the frame on three points, two at the forward end and the third at the rear. The clutch is coupled to the driving shaft by a double universal joint. The driving shaft is enclosed in a torque tube and the front end of this tube is connected to the centre cross member of the frame by a double swivel joint. The torque tube is carried by the jackshaft housing and the jackshaft housing is supported in the frame by globes and sockets, the globes being free to move in these sockets. The forward ends of the radius rods are mounted on the jackshaft housing with double universal joints, and the rear ends of the radius rods are connected at the rear axle with double swivel joints. From this system it will be understood that there will be elimination of power absorbing stresses whenever the machine is subjected to the shocks of rough roads or to heavy or unequalized loading. In the development of this construction extreme care was taken to observe conditions and results, and it was the experience that there was a decided practical benefit.



Side View of the Chassis of the K-40 Three-Ton Kelly Truck, the Latest Product of the Kelly-Springfield Motor Truck Company.

The one and three-ton chassis differ in two particulars, the one being the motor and the other the jackshaft. Because of this fact both motors and both jackshafts will be described, but the other details will apply to either.

The larger motor is a four-cylinder, four-cycle, water-cooled T head type with the cylinders cast in pairs from a high grade of fine gray iron, with bore of 4.5 inches and stroke of 6.5 inches, having a rating of 38.75 horsepower at 900 revolutions, which is the maximum speed permitted by the governor. The ratio of bore to stroke is one to 1.47, which is maintained to afford unusual power production at slow speeds, which is the work expected of a service vehicle engine. The water spaces are extremely large and circulation has free flowage about the entire length of the explosion chamber and the combustion head. Much care is taken in finishing the cylinders and the pistons. The crankcase is aluminum, cast in two sections, the upper half

of which carries the main bearings, the lower serving as an oil reservoir. In the right (exhaust) side of the top section are two large handholes that are covered with easily removable plates, and through these the crankshaft, camshaft and connecting rod bearings may be reached, examined and adjusted. There is a large drainage cap through which the crankcase may be cleaned. The forward end of the crankcase is somewhat unusual in appearance from the fact that provision is made for an outside cross shaft. In the assembly of the crankcase is noticeable a feature of construction that obtains throughout the motor, and that is the use of through bolts and castellated nuts, so that there will be little chance of slackness of parts from vibration or road shock. In fact, special provision has been made to insure against this condition resulting.

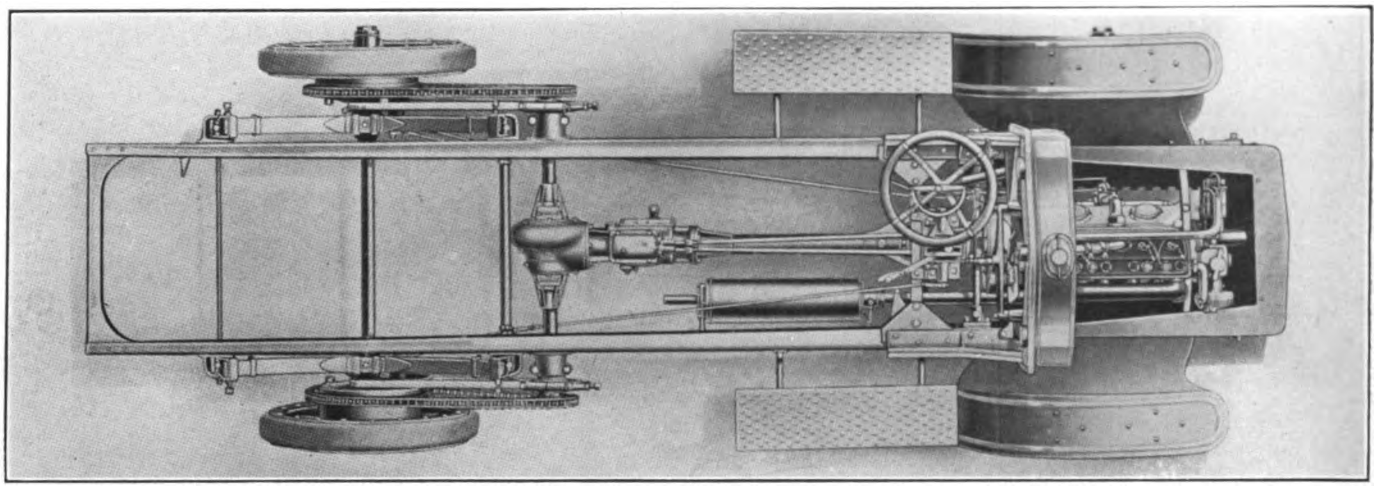
The crankshaft is a 3.5 per cent. heat treated nickel steel drop forging, 2.375 inches diameter, which is carried on three main bearings, the front and centre bearings being 3.3125 inches length and the rear bearing 5.375 inches length, this giving a total of 12 inches of longitudinal bearing surface. The crankshaft extension is of unusual length and it is supported by the long neck of the crankcase. The timing gears drive the right and left camshafts in the usual manner, and there is an extra gear that operates the cross shaft, which drives the water pump at the right side and the magneto at the left. The purpose of the additional gear is to insure against the wear that is generally experienced with spiral gears having too acute angles.

The camshafts are of liberal proportions and of high quality steel, carefully ground and treated to insure long endurance. The pistons are 6.25 inches length and the wristpins are 1.53125 inches diameter. The connecting rods are extremely light, of chrome vanadium steel, with big ends 2.125 inches diameter and 3.125 inches length. The small end bearing length is 1.375 inches. The valve action is conventional, the ports being 1.625 inches diameter and with such clearance as to insure the best scavenging and full charges of fresh fuel. The valve mechanism is completely enclosed and at either side of each cylinder unit is an aluminum cover plate that may be removed by loosening a single finger nut, which fully protects the moving parts against the accumulation of abrasive substances.

The engine is lubricated by a dry base self-contained force feed system, the oil being stored in a reservoir in the base of the crankcase which has a capacity of 2.75 gallons. A centrifugal pump creating high pressure forces the lubricant through a system of tubing to all the bearings through a hollow crankshaft and to all the timing gears, the normal flowage being about 2.5 gallons a minute at maximum engine speed. The oil drains back to the reservoir and is filtered and used over and over. There is no question that the bearings will be supplied so long as oil is contained within the crankcase.

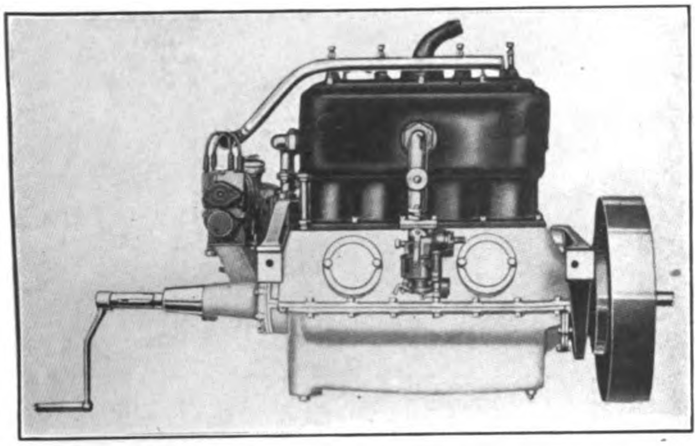
The engine is cooled by a circulation of water forced by a centrifugal pump driven by the cross shaft at the forward end of the motor through the water jackets and a tubular radiator placed back of the engine and incorporated with the dash. The radiator is supplemented by a straight bladed fan driven by a belt from the flywheel. The greatest cooling efficiency is obtained and the radiator protected against the stresses of the chassis distortion. The fuel is contained in a 20-gallon tank and is carburetted through a carburetor at the left side, the manifold being large and very free from curves. The fuel is controlled by a governor of the vertical loose ball type which is perfectly enclosed. The connection to the intake manifold is but an inch in length and the manifold and the carburetor may be removed without removing the governor. The ignition is by an Eisemann high-tension magneto fitted with a governor that automatically advances and retards the spark.

The clutch is a cone type with leather facing with springs that permit ease of engagement and certainty of control when starting. The clutch shaft is coupled to the drive shaft by a double universal joint and the main driving shaft is enclosed in a torque tube that is supported at its forward end in the centre cross member of the frame by a double swivel joint. The transmission gearset, incorporated with the jackshaft, is a selective sliding gear type with three forward speeds



Top View of the K-40 Three-Ton Kelly Chassis, Showing the Flexible Construction of the Frame and the Location of the Power and Driving Mechanism.

and reverse, the shafts being 1.625 inches diameter. The gears have 1.375 inches face. The shafts are mounted on roller bearings. The case has an inspection plate at the side so that it may be examined or the lubricant replenished without raising the floor boards of the body. The ends of the jackshaft housing are mounted in globe sockets at the sides of the chassis frame. The jackshafts are carried on taper roller bearings and are 1.625 inches diameter. The construction is the full floating type. A cover plate on the shell affords instant accessibility. The drive to the rear wheels is by side chains. The radius rods are so designed that the braking strain is taken by the solid steel forging and not by the adjusting screw, while the adjustments can be made very quickly.



Inlet Side of the En Bloc Motor of the One-Ton Kelly Wagon, of 30 Horsepower.

The frame is mounted on semi-elliptic springs 44 inches length forward and 56 inches length at the rear, so that the body rides easily and the road shocks are practically absorbed. The front axle is a carbon steel drop forged I section 2.5 by four inches, with the spring seats forged integral. This is fitted with 3.5 per cent. nickel steel steering knuckles. The spindles are fitted with large sized roller bearings. The rear axle is the same material and is three by 4.375 inches. The spindles are equipped with roller bearings. These axles are fitted with spring clips that extend through them, fastening the springs very securely. The wheel equipment is the conventional artillery type with spokes 2.5 by three inches. These are shod with 38 by five-inch single solid tires forward and 42 by five-inch dual tires at the rear. The brakes are internal expanding in drums on the rear wheels 20 inches diameter, the service brake shoes having three inches face and the emergency brake shoes 2.5 inches face.

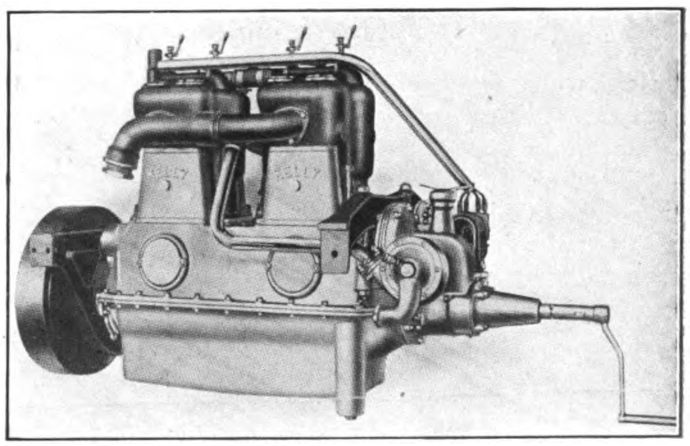
The drive is at the left side with pedals for actuating the clutch and the service brake and hand levers in the centre for operating the speed changes and the emergency brake. The fuel supply is regulated by a hand throttle on the steering column. The standard wheelbase is 150 inches with tread of 68 inches forward and 72 inches rear. Options of 130 and 172 inches wheelbase are offered to buyers. The standard loading space is 12 feet three inches, and the length with other optional wheelbases is nine, 15 and 17 feet.

The motor for the 2000-pound chassis is an L head type with the four cylinders cast en bloc and with bore of 3.75 inches and stroke of 5.25 inches. It is rated at 30 horsepower. With this construction all of the moving parts are fully enclosed and protected and the same accessibility obtains. In every respect the engine has the same features and characteristics of the larger, the cooling being extremely efficient and accomplished in the same manner, by a centrifugal pump, radiator and fan. The method of lubrication is identical and the carburetion and the ignition are as with the K-40 motor. The construction of the transmission system is the same save that the jackshaft is of the semi-floating type and the jackshafts are of vanadium steel, 1.375 inches diameter. The ends of the shafts fitting the differential gear are squared and the outer ends have flanges to which are bolted the driving sprockets. By removing either the top or bottom of the jackshaft housing the differential gear may be taken out. The semi-elliptic springs are 40 inches length and 2.25 inches width forward and 44 inches length and 2.5 inches width at the rear. The wheels are artillery type, 36 inches diameter and are fitted with 3.5-inch shoes forward and four-inch rear. The option is given of 38 by 5.5 pneumatic shoes with extra demountable rim at an additional price. The standard wheelbase is 120 inches with tread of 56 inches forward and 60 inches rear. The loading space of the regular chassis is 108 inches and with option this may be increased to 144 inches.

PIGGINS CLIMBS HEAVY GRADE.

Two-Ton Vehicle Withstands Governmental Test on Steep San Francisco Hills.

A Practical Piggins two-ton truck, made by the Piggins Motor Car Company, Racine, Wis., recently underwent a test at San Francisco, Cal., in the interests of the United States government. The car was loaded to its full capacity by the Inter-State Motors Company, local distributor of the Piggins, and the climax was reached when the machine climbed the California and Jones street hills without faltering.



Exhaust Side of the K-40 Three-Ton Kelly Truck, Rated at 40 Horsepower.

FROM LATEX TO MOTOR TRUCK TIRES.

By J. E. Hale, Experimental Department, The Goodyear Tire & Rubber Company, Akron, O.

CENTURIES ago, long before the discovery of America by Columbus, rubber or caoutchouc was known to the South American Indian. As far back as 1500, Pincon, the Spanish explorer, told of these Indians of the dense forests bordering the banks of the great Amazon, who tapped the caoutchouc trees and extracted a milky fluid. He did not explain its use. Columbus noticed natives playing ball with a curious substance grown in the primeval forests and prepared according to native ways. Little did the Spanish explorer of the 16th century dream what an important part those immense forests were to play in 20th century commercialism.

Crude Rubber Received at the Goodyear Factory, Akron, O.—1, Ceylon Crepe; 2, Manihot Biscuit; 3, Soudan Stock; 4, Fine Para; 5, Ceylon Biscuits and Sheets; 6, Cameroon; 7, Massai Strings.

In 1770 Priestly, an Englishman, found that this milky white fluid, when hardened, could be used in effacing pencil marks, and in the early part of the 19th century Hancock discovered that caoutchouc could be used in the manufacture of articles of dress. A few years later Charles Mackintosh, a Scotchman, rendered two fabrics water proof by uniting them with a solution of rubber in coal naphtha, hence the name "mackintosh" for the water proof coat.

Not until about 1839, however, 16 years later than the advent of the mackintosh, did Charles Goodyear an American, discover the method of vulcanization and make rubber fit to take its place among the most important commercial products of the world.

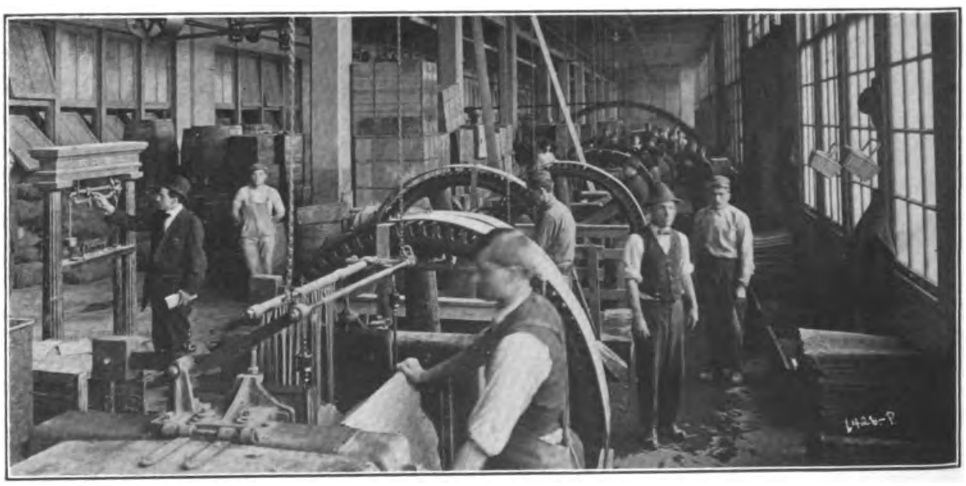
The recent increase of rubber-tired vehicles, and the introduction and the development of the automobile for pleasure and the motor truck for commercial use, have increased enormously the market for crude rubber.

In 1898 the price of crude rubber, owing to the demand created, suddenly advanced. Some years before it had been foreseen that possibly the supply of South American gum would run out, and through the efforts of American and English planters, seeds were shipped to almost every tropical climate, and cultivated rubber trees were grown with success. The best rubber, however, still grows wild in the forests on the Amazon, and according to F. A. Seiberling, president of the Goodyear Tire & Rubber Company, Akron, O., who made an extended trip down the Amazon two years ago, the supply will more than equal the demand for some years to come. In the meantime rubber plantations are springing up in many tropical countries. Some of these are already large producers of high grade gum, and the future of the supply of raw material seems to be assured.

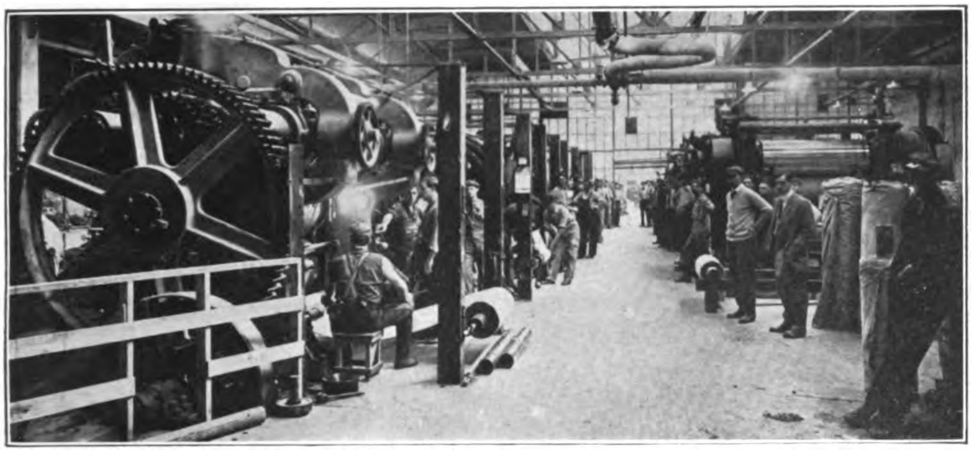
The number of tires manufactured annually for the commercial truck is increasing by leaps and bounds. Rubber men are certain the development of the truck industry in the next few years will be fully as spectacular as the development of the pleasure type of automobile has been in the past few years.

Rubber-producing trees, shrubs, etc., are found mostly in northern South America, Central America, Mexico, Central Africa and Borneo. The finest rubber obtained is fine Para, gathered in the Amazon regions of South America.

Selecting a rubber tree the natives cut V shaped grooves in the bark with a special knife made for the purpose, these grooves being cut in herring bone fash-



Washing Room at the Goodyear Factory, Where the Crude Rubber Is Cleaned of the Impurities It Contains.—Photo by Courtesy of Goodyear Tire & Rubber Company.



The Goodyear Calendering Room, in Which the Purified Rubber Is Made Into Sheet Stock for Manufacturing.—Photo by Courtesy of Goodyear Tire & Rubber Company.

ion diagonally around the tree, with one main groove cut vertically down the centre like the main vein in a leaf. The latex of the tree, from which the rubber is taken, flows from these veins and down the centre vein into a little cup at the bottom of the main vein. When the cups are filled they are gathered, and brought into the rubber camp, and there the latex is coagulated by means of smoke. This is done by the use of a paddle, which is alternately dipped into a bowl of the latex and then revolved in the smoke from a wood or palm nut fire. This smoke seems to have a preservative effect on the rubber as well as drying it out and causing it to harden on the paddle, each successive layer of the latex causing the size of the rubber ball or biscuit to increase. When a biscuit of sufficient size has been coagulated thus, it is removed from the paddle and is ready for shipment to various countries where rubber products are manufactured.

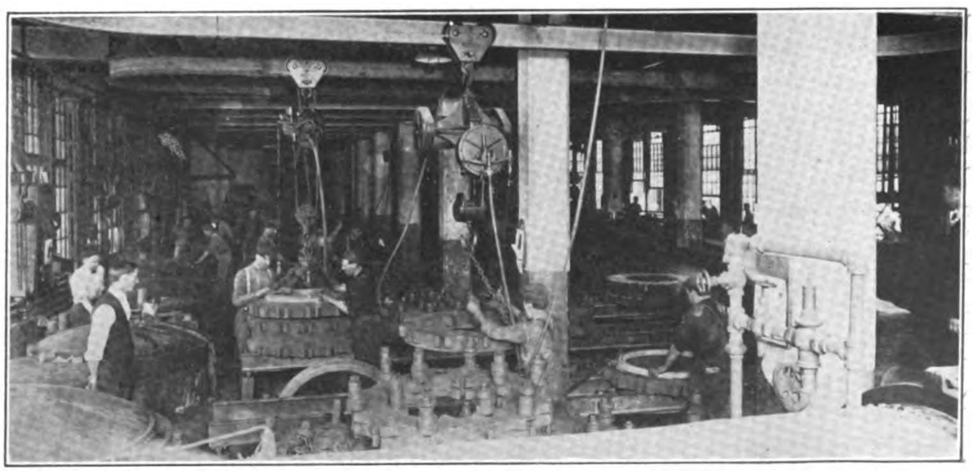
Crude rubber as it is received at the factory is more or less dirty. Sand, leaves and twigs sometimes constitute as high as 40 or 50 per cent. of the weight. These foreign substances are removed by washing the gum; one or two tons being soaked in warm water and then taken to a machine called a "cracker." The cracker consists of two large rolls covered with pyramidal projections which revolve very close together at different surface speeds. It is a powerful machine, and as the gum is fed between the rolls the projections tear it to pieces. During this process a continual flow of water from perforated pipes plays upon the rubber, and as it goes through these rolls repeatedly the water gradually washes away most of the foreign substances.

After this the gum is shovelled into boxes and taken to what is known as a "washer." This also consists of rolls, but the projections are relatively small and the rolls are nearer together. The work of removing the foreign matter is completed here, and in addition the gum is "sheeted out." Sheeting is accomplished by using warm water as the washing finishes. The heat is just enough to make the gum sticky so that from 15 to 25 pounds of rubber a sheet 18 inches wide, several feet long, and .1875-inch thick results. These sheets are then dried for from three to four weeks.

Mixing the crude rubber with the compounding ingredients is the next step. Each of the constituents of a 100-pound "batch," is carefully weighed and taken to the milling room. Here the rubber is warmed and softened before the compound is added, by passing it between the warm rolls of a machine similar in design to the washer, but much larger and with highly polished walls. The front roll revolves more slowly than the back one and the gum soon forms an envelope around this. The compound is sprinkled on the gum, a little at a time, and is gradually worked in by the constant kneading effect of the rolls on the softened gum. Finally the rolls are opened a little and the stock cut away in slabs about one-half inch thick.

Once again it is allowed to rest—this time 48 hours—when it is ready to be shaped for the rolls. In the case of rubber heels, pieces of suitable size are cut from the milled stock, but in making solid tires, where the length is many times the other dimensions it is necessary to make use of another machine. This is done by running through what is known as a tubing machine. This resembles a meat chopper on a large scale, with a die opening in place of the small holes. This turns out a continuous length of rubber of proper cross section as long as the milled stock is fed into the other end.

Then follows the weighing of each tire, cementing to the base band, laying in the mold, solting (or soap



Solid Tire Curing Room at Goodyear Plant, Where Truck Shoes Are Consolidated by Heat and Practically Completed.—Photo by Courtesy of Goodyear Tire & Rubber Company.

stoning) the mold, and placing the whole in a boiler heater where the heat for curing is supplied by steam.

The length of time required to "cure" or "vulcanize" a tire of medium size is about three hours. Taken from the heater it is cooled, removed from the mold, trimmed of the rinds at the line of contact of the halves of the mold, and the tire is ready for shipment.

Tire manufacturers have had to be chemists, inventors, analysts, and keen observers of conditions as well as mere craftsmen. They have had to establish their own precedents, to solve problems of construction and service that men have never faced before. It is a long step from the Amazon jungle, where natives slash trees and gather the sap, with chattering monkeys and brilliant parrots as an audience, to the sturdy rumbling truck that is revolutionizing traffic in the cities of the world.

Much study has gone into this fascinating phase of the development of a commercial age. Motor trucks are really locomotives. They run without permanent steel tracks (and are therefore practical) only because the rubber tree grown in the tropics, and its blood, congealed and compounded, finally makes a cushion for wheel rims thousands of miles away. Without rubber tires trucks could not succeed.

BALL BEARING THEORY AND PRACTISE.

Important Discussion on This Subject Prepared for Society of Automobile Engineers.

Franz J. Jarosch, M. E., a member of the Society of Automobile Engineers, has prepared for the metropolitan section of the society a series of discussions on the theory and practise of ball bearings, the first of which, under the title of "The Work of Balls and Ball Raceways in Radial and Thrust Ball Bearings with Respect to Friction and Load Relation," has been published in the S. A. E. Bulletin for November. The subject has been taken up with extreme care and different forms of journals, from plain to the separate ball type, are considered exhaustively, and the efficiency shown by admirable calculations.

The work is technical and contains a very large volume of information that is valuable to engineers, while there is no doubt of the quality of the ball bearing as compared with other types even to the casual or non-technical reader. It is seldom that a subject has been so thoroughly presented as has this, and it is illustrated with a series of drawings, each of which is clearly explained. As a contribution to engineering literature Mr. Jarosch may be praised for his work, for it is decidedly valuable and should be included in the library of every man who has to do with problems of transmitting energy or power. The address of the Society of Automobile Engineers is 1786 Broadway, New York City.

The Bosch Magneto Company, maker of Bosch magnetos, will have a special display at 223-225 West 46th street during the New York show.

NEW TRUCK WARRANTY.

National Association of Automobile Manufacturers Will Supply Blanks to Non-Members.

The new standard motor truck warranty adopted by the National Association of Automobile Manufacturers is ready for use. Handsomely lithographed copies are bound in book form, like bank check books, and these are available to non-members of the association, who desire to use the standard warranty in selling their product. The only changes made in the printed matter, in such instances, are in the name of the company, address and titles of officials signing the warranty, a sample of which appears below. Those desiring blanks should apply to H. W. Perry, secretary, commercial vehicle committee, N. A. A. M., 7 East 42nd street, New York City.

WARRANTY NO.——— TRUCK NO.———

This is to certify that we, the
SAMPLE MOTOR TRUCK COMPANY,
of Detroit

WARRANT the new motor trucks manufactured by us to be free from defects in material and workmanship, this warranty being limited to making good at our factory any part or parts thereof which shall, within ninety (90) days after delivery of the truck to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective.

The warranty shall not apply to any truck which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect its stability or reliability, nor to any truck which has been operated at a speed exceeding the factory rated speed, or loaded beyond the factory rated load capacity, or which has been the subject of other misuse, negligence or accident.

We make no warranty whatever in respect to tires, rims, ignition apparatus, lamps, gas tanks, signalling devices, generators, batteries or other trade accessories, inasmuch as they are usually warranted separately by their respective manufacturers.

The foregoing obligation to make good any defective parts returned as herein provided is in lieu of all other warranties expressed or implied, and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our trucks.

It Witness Whereof the said Company has caused this Warranty to be signed by its duly authorized officers.

................Treasurer. ....Vice President

Dated........................, 19

MOTOR VS. EIGHT-MULE TEAM.

In Arizona Test Former Does Work in Ten Minutes, While Mules Take Seven Hours.

Recently a trial was made in the famous Fish creek between Phoenix and the Roosevelt dam, Arizona, to test the relative efficiency of the mule team and the motor truck. From the bottom to the top of the hill is 1.75 miles and the average grade is 10 per cent. It took an eight-mule team seven hours to haul a five-ton load up the grade. A motor vehicle took the same load up in 10 minutes.

A Federal truck, made by the Federal Motor Truck Company, Detroit, and fitted with a 20-passenger body, operates over this same road. It has been making daily runs for eight months between Phoenix and Roosevelt. Not once has the truck caused its owner any trouble. The latter is thinking of purchasing another Federal owing to the increase in his business.

50,000 TRUCKS OWNED IN UNITED STATES.

In a Few States Only Service and Pleasure Car Registration Is Segregated---900,000 Cars and 100,000 Motorcyles a Reasonable Figure---Actual Facts of Record.

MORE than one million motor vehicles are owned in the United States. This statement is not made upon estimate or without knowledge of actual conditions, and it may be stated that if motorcycles are included this figure will be considerably exceeded. The proportion of this number that is given over to business service is uncertain, but there is reason to believe that it will at least total 50,000.

To obtain the most definite information possible MOTOR TRUCK has secured the registration from every state official of jurisdiction save two, and has included in one instance the statement made by the manager of the leading commercial body of another state in which vehicle registration is not required by law.

To understand the true significance of the figures, which represent 37 of the 48 states, and the District of Columbia, it is necessary to point out that of a total registration of 970,427 motor vehicles of all kinds 56,710 are motorcycles, these being obtained from 22 states and one district. In 10 of the remaining 15 states from which statements have been secured, motorcycles are included with the general registration. It is extremely probable that the number of motorcycles included in the motor vehicle registration in the states of Delaware, Georgia, Indiana, Nebraska, Ohio, Tennessee, Washington, West Virginia and North Carolina, if separated, would materially affect the deductions that will be made.

The figures show in these 37 states a total of 200,204 pleasure vehicles that are registered as such, 17,679 service wagons that are so classified, 695,834 that include pleasure cars, commercial machines and motorcycles, and the 56,710 motorcycles. It is not the purpose to deal with the pleasurė machines other than to show the surprisingly large number in use.

In considering the motor vehicles owned in the United States it will be necessary to refer frequently to the following tabulation, and it will be noted that there are no entries for the states of Arizona, Colorado, Idaho, Kansas, Louisiana, Nevada, South Carolina, Texas or Wyoming, which either have no registration law, or merely local ordinances, and from Florida and Oklahoma, from which states no return was received:

State	Pleasure Cars	Service Wagons	Motor-cycles	Motor Vehicles Un-classified	Total Vehicle Regis-tration
Alabama	3,010	130	220	....	3,360
Arkansas	....	....	....	2,000	2,000
California	....	....	....	88,867	88,867
Connecticut	....	....	2,525	17,875	20,400
Delaware	....	....	....	1,732	1,732
Georgia	....	....	....	18,100	18,100
Illinois	....	....	9,236	67,913	77,149
Indiana	....	....	....	65,000	65,000
Iowa	....	....	4,209	44,141	48,350
Kentucky	....	....	....	5,384	5,284
Maine	7,880	265	358	....	8,503
Massachusetts	46,096	4,036	5,034	....	55,266
Maryland	9,710	733	1,859	....	12,302
Michigan	....	....	3,620	39,569	43,189
Mississippi	....	25	....	2,855	2,880
Missouri	22,087	1,301	973	....	24,361
Montana	300	100	47	....	447
New Jersey	....	....	6,171	42,852	49,023
Nebraska	....	....	....	33,921	33,921
New York	95,319	9,649	....	....	104,968
North Dakota	....	....	470	9,470	9,940
Ohio	....	....	....	63,125	63,125
Oregon	8,284	695	1,183	....	10,162
Pennsylvania	....	....	7,314	59,334	66,648
Rhode Island	7,518	745	780	....	9,043
South Dakota	....	....	750	15,200	15,950
Tennessee	....	....	....	9,993	9,993
Washington	....	....	....	13,000	13,000
West Virginia	....	....	....	3,090	3,090
Wisconsin	....	....	4,060	24,578	28,638
Virginia	....	....	714	5,760	6,474
Vermont	....	....	204	4,381	4,585
North Carolina	....	....	....	6,200	6,200
New Hampshire	....	....	590	6,710	7,300
Minnesota	....	....	4,000	29,000	33,000
New Mexico	....	....	....	886	886
District of Columbia	....	....	2,393	12,346	14,739
Utah	....	....	....	2,552	2,552
Total	200,204	17,679	56,710	695,834	970,427

The Motorized Traffic of New York City: The Stream of Pleasure and Public Service Machines Pouring North Through Fifth Avenue.—Photo Copyrighted by Underwood & Underwood, New York.

In the United States as referred to in this article the 48 states and the District of Columbia are included, and the District of Alaska and the island possessions are not considered, though the number of machines owned in them is perhaps worthy of consideration from the viewpoint of accuracy.

The registration in the instance of Utah is of Nov. 25, and in Massachusetts of Nov. 30, while in the other

states the dates range from Dec. 7 to 12, so it will be understood that the figures are distinct and dependable. To understand exactly what is comprehended by the registration laws would require a digest of each, but if there is any one thing noticeable it is the extreme variance of the requirements of the law. In Arkansas, California, Mississippi, New York and Utah it is not necessary to register motorcycles, but in Delaware, Georgia, Indiana, Kentucky, Nebraska, North Carolina, Ohio, Tennessee, Washington, West Virginia and Minnesota they are classified indiscriminately with the pleasure cars and the service wagons.

Of those states from which no figures are obtainable it is certain enough that a very large total is entirely reasonable. For instance, Kansas should more than equal the registration of Nebraska; Colorado should approach that of Rhode Island, at least; Louisiana will probably exceed that of Mississippi; South Carolina will no doubt reach that of North Carolina; Arizona, Nevada, Idaho, Oklahoma, Wyoming, Texas and Florida should equal the registrations of New Mexico; New Mexico, Montana, Kentucky, West Virginia, District of Columbia and Delaware, which should be compared in the order given. The total registration for the states taken as a basis of estimate is 76,815, and this will bring the total of vehicles for the nation to approximately 1,050,000.

Just a word about the registration requirements before dismissing the subject: In Arizona, Colorado, Idaho, Kansas, Louisiana, Montana, Nevada and Wyoming there is no provision for registration. Local ordinances exist in Colorado, Louisiana and Wyoming, but only in a few of the cities. It is obviously impossible to obtain figures from each community and all statements concerning registration in these states are without basis of actual data. The statement relative to Montana is supplied for the table by the manager of the Commercial Club of Helena, and is no doubt conservative. In South Carolina the registration is with the clerks of the county courts, and in Texas with the county clerks, and it would manifestly be impossible to obtain the facts save by reaching each official direct.

It will be noted that the statements do not specify the manufacturers and dealers in motor vehicles, and it would not be possible to supply this information without a digest of each law separately. In Massachusetts in the year of 1912 1114 manufacturers and dealers were licensed, and in Illinois during the same period 871, or a total of 1985 which does not appear in the aggregate. Not only this, some of the manufacturers and dealers have a number of machines operated under the same license number, and vehicles not in use need not be licensed, so it will be seen that the figures do not adequately represent the actual number of motor driven conveyances. As these licenses are generally granted annually it may be accepted that there are but few issued that do not represent a vehicle. While it is true that some machines have been registered in two states, these comprise a comparatively small part, and taking Massachusetts as an example, where last year 881 licenses were granted to non-residents (not included in the total of registration of that state), it will be seen that the percentage there is about 1.51, and the average will probably be not more than half of that figure. Oregon apparently has the best classification of its vehicles, which are divided into gasoline and electric pleasure cars, and the service machines are grouped as trucks, commercial cars, taxicabs and undertakers' hearses.

Considering the service vehicles, it will be noted that Alabama, Maine, Massachusetts, Maryland, Mississippi, Missouri, New York, Oregon and Rhode Island, with the estimate from Montana, have a total of 17,679, of which 9649 are in New York and 4036 are in Massachusetts. Missouri has 1301. It is but reasonable to believe that Arkansas, California, Connecticut, Delaware, District of Columbia, Georgia, Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, New Hampshire, New Mexico, New Jersey, Nebraska, North Dakota, North Carolina, Pennsylvania, Ohio, South Dakota, Tennessee, Vermont, Virginia, Washington, West Virginia, Wisconsin and Utah, and which include all of the principal cities of the country aside from New York, Boston, Buffalo, Providence, Rochester, Syracuse, Albany and Troy, will at least have double the number of machines stated, so that 50,000 is well within the bounds of conservatism.

But assuming that this figure is definite, it will be seen that practically a fifth of the machines in use are in New York State, and this being so the possibilities of the market in all the other states must be apparent. It will not be denied that a large proportion of the motor vehicles is owned and operated in the cities, and it is no less certain that the use of both cars and wagons will become more general in the smaller cities and towns each year.

It may be well to regard the motor vehicle market for a moment from another aspect. Assuming that the total number of machines of all kinds in serviceable existence is 1,050,000, of which there are 50,000 service wagons and 100,000 motorcycles, this leaves about 900,000 pleasure cars, or about one to every 90 persons, assuming the population is 80,000,000. This would seem to indicate that there is a production of pleasure machines that will be adequate to meet all requirements with the normal facilities and resources of the industry. But with a very much greater number of service wagons needed for the haulage of the nation, and the demand increasing, the possibilities for supplying the market are far from adequate. This does not mean an appeal for expansion, but it does demonstrate the actual need of educating the people to the classes and types of machines that are suited for the innumerable purposes demanded by business requirements.

As an illustration of the possibilities for service machines one can contrast the 4000 vehicles of Massachusetts and the 3,000,000 population, or the 9500 wagons of New York with approximately 8,000,000 inhabitants of the state. Taking the number in Massachusetts and 80,000,000 population as a basis it

would be necessary to have 320,000 motor wagons to have the same ratio throughout the country. It is safe to assume that any person familiar with transportation in Massachusetts will admit there is yet but a small number of machines in that state when compared with animal conveyances. This being so it is well within the limitations of good judgment to affirm that the market has not even been prospected. Not only this, with the rapidity with which the people are acquiring knowledge of transportation it will require much more than the normal production of the industry as it now is to keep pace with the demands.

FEDERAL TRUCK IN DAIRY SERVICE.

ROBERT G. Miller, proprietor of the Highland Dairy, Bloomfield, Conn., has been using for the past few months a one-ton Federal four-cylinder gasoline truck with excellent economy. He expresses satisfaction with the machine and after an experience of two years says that the motor truck is far superior in his opinion to horses for milk delivery.

Mr. Miller asserts that under no circumstances would he resume the use of horses unless motors were not obtainable. He has learned by experience of motor truck efficiency and knows whereof he speaks. He now has 10 horses on his farm of 225 acres, but uses them for farm work only.

The one-ton Federal, Mr. Miller's second truck, has been driven about 7000 miles. The Miller dairy is about 6.5 miles from Hartford and the route for the most part is over good roads with few hills. The average daily mileage is about 25 miles.

From figures given it appears that the daily cost of operation is $3.50, to carry an average load of 1600 pounds. The car is used every day in the year, as Mr. Miller delivers milk seven days in the week. Just how the cost of $3.50 a day is established is explained at the end of this sketch.

Mr. Miller states that to do the same work with horses he would need four. Feed would cost 80 cents a day a horse or $3.20 for the four. Two horses would be used each day; that is, each pair would work alternate days, as it is considered too hard work to use them seven days in the week. Then, too, it must be considered that the horses might be incapacitated at times.

Mr. Miller supplies the restaurants of the Underwood Typewriting Company, the Pope Manufacturing Company, main and west works; the Royal Typewriter Company and the Hartford Golf Club. In addition to this he also delivers 150 quarts of milk (from house to house) daily. All his trade is west of Broad street, or approximately three-quarters of a mile from the centre of the city. Mr. Miller was asked how he happened to purchase a car and he stated that it was a case of buy a motor truck or go out of business.

The Federal is Mr. Miller's second car. He had a two-cylinder machine but this caught fire and was damaged so he disposed of it and bought the machine he now uses. Speaking of this first car, he states that it gave good service the 17 months it was used, but the pneumatic shoes were more expensive than he has found solid tires.

The Federal is also used in the open season for road work. With it men and supplies are transported from one place to another. During the past season Mr. Miller oiled 32 miles of road in the towns of Bloomfield and Granby.

Saves Three Hours a Day.

Just what the truck means to the owner is obvious when it is known that it saves three hours a day. It leaves the dairy at 7 in the morning and is back at noon. Using horses Dairyman Miller arose at 3 in the morning or thereabouts, left home at 4 and was delivering milk in Hartford at 5. "I have been peddling milk since 1893," said Mr. Miller, "and I have had my share of the hard work."

Federal Truck That Does the Work of Four Horses Regularly and Occasionally More, at a Cost of $3.50 a Day.

"Do you consider that the truck saves time?" he was asked.

"I save three hours a day and that means a lot in the planting and cultivating season. It also gives me a little more leisure and a chance to more fully enjoy life."

Many of the dairyman's neighbors, engaged in the milk trade, start three hours earlier and he is at home two hours before they return from the city.

The truck is used to good advantage for other work, but not for plowing, as the owner says he regards a traction engine more suited for such purpose. This autumn Mr. Miller transported 90 barrels of apples to Simsbury, over a mountain, where the apples were converted to cider and got the apple juice back

home in one afternoon after a day's work in the city. Mr. Miller also hauls his own coal.

The cost of operating the machine is as follows:

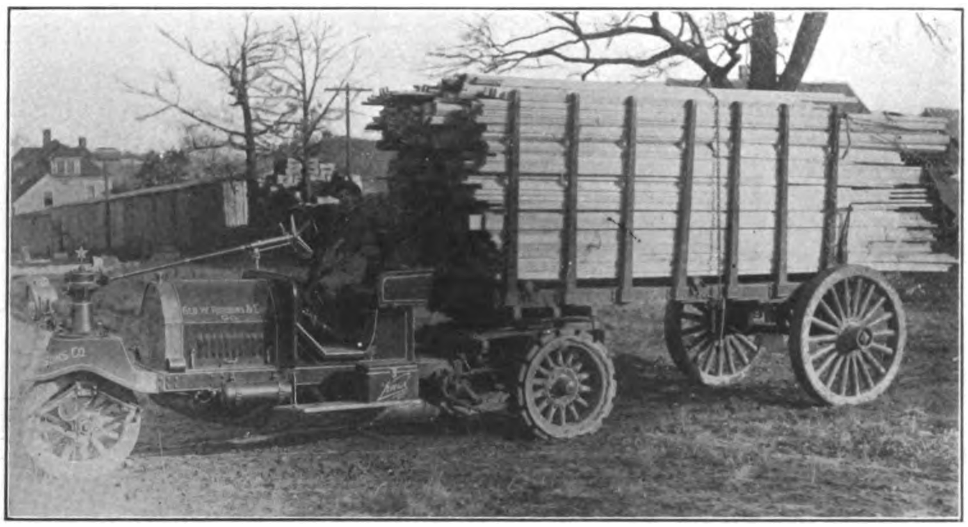
Interest of $1950 at 6 per cent	$117.00
Depreciation at $50 a month	600.00
Tires at one cent a mile, 12,000 miles	120.00
Gasoline and oil at 90 cents a day	328.50
Insurance	111.00
Total cost for year	$1276.50
Cost a day, 365 days to the year	$3.495

It will be noted that depreciation is charged off at $50 a month or $600 for the year. This is approximately 30.6 per cent., which is very high. To date the only expense has been 90 cents, 30 cents of which was for a half hour's labor in soldering a gasoline pipe, and 60 cents for an hour's labor in putting bolts on the sod pan. Mr. Miller states that an allowance of one cent a mile for tires is liberal. As the owner drives the car himself no charge is made for this usual item of expense which is about $2.50 daily.

MARTIN TRACTOR IN LUMBER HAULAGE.

While it is admitted by many lumber dealers that the motor truck is able to demonstrate an economy over horses in the haulage of this product, the chief difficulty lies in securing maximum efficiency. With the increased investment in equipment it becomes especially desirable to keep the truck at work as large a percentage of the time as is possible, particularly as there is no need for rest periods as with horses.

An accompanying illustration presents the Knox Martin tractor, made by the Knox Automobile Company, Springfield, Mass., and in service with the George W. Robbins Company of that city. Inasmuch as this concern has been using a two-ton Knox truck for the past two years and with considerable success, it will be conceded that its experience with both motor vehicles and horses has been such as to indicate the value of its opinion regarding the newer installation.



Knox Motor Tractor Utilized in Lumber Service with the George W. Robbins Company of Springfield, Mass.

This tractor is designed actually to take the place of the horses, the lumber being loaded on the ordinary horse wagon. It will be noted that the forward wheels have been replaced by the regulation motor truck road members attached to the rear of the tractor. While the latter is absent from the yard delivering the previous load, this forward portion of the wagon is rested upon wooden horses or some other similar arrangement, and the tractor backs under the load, is connected and is on its way again without perceptible loss of time. The Robbins Company uses its tractor in all sorts of service, including long hauls to Northampton, Palmer and Westfield, covering distances varying from 10 to 20 miles. It believes it has solved the loading and unloading problem effectually.

GOOD YEAR OF BUSINESS.

Merchant & Evans Company Reports Increase of 30 Per Cent. Over That of 1911.

In discussing the results obtained during 1912, Powell Evans, president of the Merchant & Evans Company, Philadelphia, maker of Hele-Shaw clutches, axles, transmissions, etc., reports that the volume of business done may be rated conservatively at 30 per cent. greater than in 1911. In some departments the increase was over 100 per cent. Concerning the matter of collections and losses, he says that the former are in excellent condition and the latter average less than in the previous year.

The various plants of the company have been taxed to their fullest capacity, and during a portion of the year time shifts were found imperative. Early in the year a site in the Wheeling-Pittsburg district was purchased, the idea being to secure the advantages of fuel, transportation and ideal manufacturing conditions. The dipping plant accordingly was removed from Philadelphia to Warwood, W. Va., just outside of Wheeling, and additions to the Philadelphia plant are now under way to take care of the greatly increased business in automobile parts.

The business for 1913 appears to Mr. Evans as most favorable. He adds that the company is prepared to fill all orders promptly, and that the plants in Philadelphia, Chicago and Warwood are all running full time. During January and February the removal and rearrangement of the Philadelphia works will not be permitted to interfere with spot deliveries.

LOCAL ACTION IN LEAD STORAGE BATTERIES.

By James M. Skinner.*

IN CHARGING storage batteries the current is obtained from a dynamo driven by a steam engine which receives steam from a boiler. Every effort is made to keep the boiler and engine and dynamo working at the highest efficiency. Perhaps mechanical stokers and feed water heaters and fuel economizers are used on the boilers, perhaps the steam lines are asbestos covered; surely the connections and stuffing boxes are kept tight, and dynamo brushes and commutator regularly inspected and attended to. All this to prevent loss of power—to save the coal pile. Power losses in a storage battery other than the normal watt-hour efficiency losses are very small. Nevertheless even small daily savings may add up to a considerable sum in a year's time, and when better battery service is added as an additional inducement, it may be worth while to consider how to eliminate even the small battery losses. These are the result of local action, a rather broad term covering several kinds of internal and therefore wasteful discharge. It will be the purpose in this paper to distinguish between the various kinds of local action, and their causes, and to outline certain simple precautions which will either entirely prevent them or will reduce their effects to a negligible minimum.

Local action may be divided into three very general classes:

1. Mechanical.
2. Chemical.
3. Electro-chemical.

The three types will be considered separately.

Mechanical Local Action.

Mechanical local action has no part in the normal working of a battery. It is the result of a short circuit between positive and negative plates in a cell. In rare cases this results from poor lead burning, a "run-down" from the positive group touching a portion of the negative group or vice versa. This, however, is the result of inexcusable carelessness, since a simple inspection of the groups after burning and assembling is sure to reveal it. A short circuit from a piece of lead dropped into a cell is in the same category. In some batteries short circuits occur, due to growth of the negative active material over the tops of the negative plates until it touches the lead apron separator hold-down on the positive group or bridges over the separator tops on to the adjacent positive plates. Such trouble, however, cannot occur on batteries made by the writer's company, because the negative material has little or no tendency to grow and because the separator hold-downs are of wood instead of being lead aprons attached to the straps.

In cases where a battery is abused by overheating trouble is sometimes experienced with the wood separators. Most battery owners, however, are careful not to overheat their batteries, and wood separators, which have been given a proper preliminary treatment, generally last the whole life of the battery.

Chemical Local Action.

Under the head of chemical local action will be considered here the effect of too strong sulphuric acid upon the capacity of a battery. A battery normally discharges by absorbing acid from the electrolyte, forming lead sulphate in the plates, and delivering over the external circuit an amount of current proportional to the amount of lead sulphate formed. In order that lead sulphate shall not form without the production of current the specific gravity of the electrolyte is limited to a maximum of 1.300 at full charge; 1.300 electrolyte contains about 40 per cent. of sulphuric acid. If the electrolyte contains more than 40 per cent. of sulphuric acid, that is, if its specific gravity is above 1.300, it will attack the negative plate, forming lead sulphate from the sponge lead, but in this case without the production of any current. In other words the battery discharges without doing any useful work. Moreover the strong acid is detrimental to the wood separators, and the lead sulphate formed is sometimes rather hard to reduce back to sponge lead.

The precaution against any such trouble is exceedingly simple—merely be sure never to add acid to a battery under normal conditions. It is never safe to add acid to a storage battery except upon the advice of a competent expert. No acid is ever lost during the normal working of a battery. The acid which was put in it when new is used over and over again. On each discharge it is absorbed by the plates; on each charge it is returned by the plates to the electrolyte. Unless some is spilled out, it is sufficient, without any replenishing, to serve during the whole life of the battery. After the battery has been charged several times it may seem as if acid has been lost, because the electrolyte level gradually falls. This fall is due to the loss of water by gassing and by natural evaporation, not to the loss of acid, and it should be compensated for by adding pure water only, once a week, more or less, never by adding acid.

Electro-Chemical Local Action.

Electro-chemical local action results from impurities in the electrolyte. Such impurities may be acids other than sulphuric acid, or metals other than lead. Neither has any place in a normal battery. Acid trouble is rather infrequent and there is no easy way for it to occur except through the introduction of hydrochloric acid in the form of common salt or salt water. If it will just be remembered that salt and salt water should not be allowed to get into a battery, the subject of acid impurities may be dismissed.

Metallic impurities are more common, but just as easy to avoid. They are of two classes. Some, such

*Engineer of the Philadelphia Storage Battery Company.

as iron, can exist in the electrolyte in two states of oxidation, and, by travelling between the positive and negative plates, being oxidized to the higher state of oxidation by the former and reduced again to the lower state of oxidation by the latter, can cause the formation of lead sulphate and consequent useless discharge of both positive and negative plates. A small amount of iron, given enough time to travel back and forth and to oxidize and reduce, can completely discharge the battery.

Other metals such as copper and platinum are not so active in travelling between positive and negative plates, but confine their attention more to discharging the negatives. As a battery cannot work with discharged negative plates, this is almost as bad as discharging both plates. During charge the impurities deposit on the negative plates in the metallic state. When the charge is stopped the deposited impurity forms with the sponge lead a little internal primary battery. A complete circuit being made by the conducting sponge lead, this little cell starts immediately to discharge. The copper (or other metal) dissolves and lead sulphate is formed in the sponge lead just as during a normal discharge of the battery, although in this case as in the other cases of local action cited, no useful work is performed.

Nothing but Purest Materials Used.

Reliable battery manufacturers are extremely careful to use nothing but the purest materials in the manufacture of their batteries. The writer's company, and undoubtedly some of the others, maintain extensive laboratories and employ trained chemists to do nothing but constantly supervise the purity of all materials entering into the construction of their batteries. They are absolutely sure that when a battery leaves their hands it is as free from impurities as it is possible to make it. To keep it in this condition it is necessary to observe practically only one simple precaution—use only pure water, preferably distilled, for maintaining the electrolyte level one-half inch over the plates Distilled water is safest because it is almost sure to be free from impurities. Natural water is sometimes safe and sometimes unsafe. It should not be used unless analyzed and reported on by the battery manufacturer from time to time. A very small amount of impurity in a sample of water is not a sufficient reason for assuming that the water is safe for battery filling, because although the water of each addition evaporates in, say, once a week, its impurities do not evaporate, but remain in the cell. The amount added in one filling may be small, but the accumulation of the impurities from several months' or a year's filling may be sufficient to cause a considerable amount of local action.

In conclusion, so that there may be no chance of a mountain being made of a molehill, it may be well to summarize the precautions which should be taken in order to practically eliminate local action. Two of them are negative—do not overheat and do not add acid, the last is positive--fill only with pure water, preferably distilled.

NOW WESTERN ELECTRIC-PITTSFIELD.

Two Well Known Electrical Concerns Form Alliance for Marketing Former Pittsfield Products.

An alliance between the Western Electric Company, New York City, and the Pittsfield Spark Coil Company, Dalton, Mass., about which rumors have been in circulation for some time, has been confirmed by both concerns. The Western Electric Company is one of the largest companies in the United States, doing an annual business of approximately $70,000,000, and its large engineering force will work in conjunction with the Pittsfield engineers in developing new apparatus.

Under the arrangement between the two companies the entire line of Pittsfield products, including magnetos, spark coils, spark plugs, timers and switches, are now to be marketed exclusively by the Western Electric Company, under the name of Western Electric-Pittsfield, although for a time the Pittsfield company will continue to market some magnetos direct. The sales efforts of the Western Electric Company will be directed largely toward manufacturers and supply houses. Ample stocks will be carried at each of the 28 Western Electric distributing houses located at shipping centres throughout the country. This brings the Western Electric-Pittsfield products within overnight shipment of every automobile manufacturer, dealer and owner.

LOCATES IN WASHINGTON, D. C.

American Motor Traffic Company to Produce and Operate Heavy Duty Vehicles.

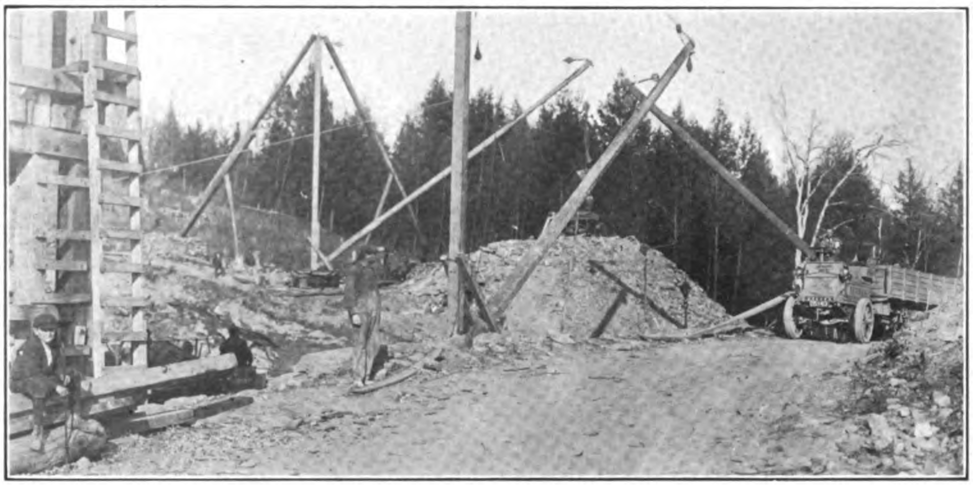
The American Motor Traffic Company, incorporated under the laws of South Dakota, was formally organized at Washington, D. C., where it will occupy the fourth floor of the new Citizens' bank building at 1421 G street, N. W. The directors of the company are: President, E. S. Alvord, president of the Littlefield & Alvord Express Company; first vice president and acting manager, S. J. MacFarren, manager of the Engineer Searching Company; second vice president, W. J. Moore, president of the Moore Company; secretary, A. L. Kley of New York City; J. C. Muncaster of Washington and J. C. Menocher of Pittsburg.

The company will specialize in heavy duty commercial motor vehicles of the pivoted spindle, multiwheel drive and steer type, with flexible load suspension and balance and also in liquid fuel combustion engines and vehicle accessories. Many other items of improvement in vehicle construction are controlled by the company under patents granted to Messrs. MacFarren, Thomas and others and further protected by special trade marks. The concern is empowered to operate as well as manufacture motor vehicles for all uses and proposes to establish freight, express and passenger services in response to demand, through its exclusive state agencies or auxiliary companies.

LOCOMOBILE TRUCK EQUAL OF 25 HORSES.

THE Bridgeport Hydraulic Company, Bridgeport, Conn., has demonstrated the practicality of motor trucks in construction work, such as is usually engaged in by contracting companies, and has found by comparisons made with animal service and conservatively estimated costs, that they are remarkably economical. The company owns the system of water supply for Bridgeport, the reservoirs, pumping stations and distributing mains, and the corporation is administered from a business point of view. The reservoirs are located outside of the city and to meet the consumption by the rapidly growing population a storage reservoir was projected at Easton, seven miles distant, on which work has been progressing the past year.

This basin is situated at a considerable height above the city and it is formed by the construction of a dam in a ravine. This dam is built with great strength and it is expected to endure for an extremely long period. Besides the dam, with the gates, sluiceway and outlets, the bottom of the reservoir is being so constructed that there will be a minimized loss of water through leakage. The work has been in accordance with the most advanced engineering and the requirements for material has necessitated the haulage of hundreds of tons from Bridgeport to the dam. As the most economical mechanical facilities and tools were used the same judgment that impelled their installation also considered the transportation of the materials and supplies. These included cement, machinery, pipe, tools, coal, lumber, etc.



One of the Two Locomobile Five-Ton Trucks Used by the Bridgewater Hydraulic Company, Bridgeport, Conn., That Takes the Place of 25 Horses in Construction Work.

The road from the railroad and shipping terminals at Bridgeport to the dam is across a number of hills, and is rough and at times extremely muddy and soft. The highway is not well surfaced in any part and the gradients are frequent and generally steep. The work was begun early in April and it was concluded to purchase two Locomobile five-ton machines, these to take the place of animals. Before purchasing the trucks the company made an effort to learn some accurate figures relative to horse haulage and made tests with coal carrying with a horse drawn cart. A four-horse team was used and hauling a four-ton load two round trips were made, a total of 28 miles, but it was evident that this work could not be continued if the animals were to be used every day. The cost of the team and cart was placed at $3.50 and the wage of the driver $2, this being a total of $5.50 a day, which is obviously extremely low, for very careful estimates have established $7 a day as a reasonably conservative figure. The ton-mileage was 56, when 40 is regarded as the maximum that could be expected from animal teams of this character. It will be seen that the cost accepted for animals was approximately 28 per cent. less than the average, and the horses did 40 per cent. more work than the normal maximum, so it will not be maintained that the standard by which comparison was made was in any way favorable to the machines.

The service conditions were such that to work horses regularly they should be driven two trips one day and one trip another, to prevent overworking them, which would materially reduce the load tonnage and mileage and decidedly increase the cost of transportation, taking the figures stated as the standard by which to determine efficiency and expense.

The trucks were worked on the basis of capacity loads and it was believed that four round trips was the maximum work, this giving a total of 56 miles daily, as against the two credited to the horses, and carrying a ton larger load each trip. But it was found after experience had been gained with loading and unloading and the road was better known that five round trips could be made without overworking the crew, giving 2.5 times the horse mileage and with a 25 per cent. larger load. But as a matter of fact the five trips represented 3.5 times the normal horse mileage.

The cost of operating the trucks was placed at $15 a day when four trips were made and $18 a day for five trips, and it was believed that these figures were very liberal and would leave a margin after providing for every item of expense. Considering the daily allowance of $5.50 for the horses for hauling coal 56 ton-miles the cost was placed at $0.1607 a mile, and allowing $15 as the expense for hauling coal 140 ton-miles the cost was fixed at $0.1071 a mile, or a difference of $0.0536 a mile. By this it will be seen that the truck did the work almost exactly 50 per cent. cheaper than the horses. But when the work for the five trips is considered it is found that the cost for carrying coal 175 ton-miles is $0.1029 or $0.0578 a mile less than

horses. Taking the truck cost as the basis of haulage the cost of the horse transportation is .561 more. This is a remarkable showing and were the extremely low horse cost considered it is probable that the saving would be not far from 100 per cent.

The following tabulation shows the facts as stated more graphically:

		Ton-Miles		Cost a Day		Cost a Ton-Mile	
Trips	Miles	Horses	Trucks	Horses	Trucks	Horses	Trucks
1	14	28	25	$5.50	$15		
2	28	56	70			$0.1607	
3	42	..	105				
4	56	..	140				$0.1071
5	70	..	175		$18		0.1029

Before the trucks were utilized the officials of the company were seriously considering the building of a road on a hill to reduce the grade, but after the machines had been driven for a short time this was found to be unnecessary. While no record appears of this fact, it is realized by the company that the trucks undoubtedly did save a considerable item of expense Had the use of horses continued this work would have undoubtedly been undertaken.

One of the officials of the company is credited with the statement that the trucks are actually taking the place of 25 two-horse teams. Besides this it is found that the trucks are not as destructive of roads as are horse carts fitted with narrow steel tires, and that the road traffic has been reduced, with the elimination of the delays necessitated for turning out for other vehicles. Neither is there the congestion, loading or unloading.

MURPHY LEAVES GENERAL MOTORS.

Will Establish Branch of Well Known Advertising Agency in Detroit.

Gleeson Murphy, for the past two years assistant to President Neal of General Motors Company, has opened a branch at Detroit for the H. K. McCann Company of New York, one of the strongest and best known advertising agencies in the United States. Mr. Murphy, who is a student of big organizations, leaves the General Motors Company with the asset of having materially assisted in the reorganization of that company and his purpose is to establish a complete advertising agency in Detroit, backed by the best experts in the merchandising line.

The McCann company is composed of general advertising experts of national reputation, including H. K. McCann, former advertising manager of the Standard Oil Company; Herbert W. Casson, well known writer, orator and efficiency expert; Thomas Nast, president of Nast art school; Gerald B. Wadsworth, author of "Principles and Practises of Advertising;" R. M. St. Hill, A. E. Foot and H. Atwood.

Mr. Murphy, besides having the advice of these men, will be assisted by a local corps of experienced writers and artists. He begins his new enterprise with a high degree of fitness for his work, his experience in handling large sales problems being a strong asset. The offices will be in the Boyer building, Detroit.

MORELAND FOR OIL TRANSPORTATION.

Special Loading and Unloading Device Aids in Handling Road Construction Materials.

One of the latest products of the factory of the Moreland Motor Truck Company, Los Angeles, Cal., is a five-ton chassis equipped with a 1500-gallon tank for the transportation of asphaltum and heavy oil for use in the construction of roads. The truck was constructed for the Brashror Burns Company, road building contractor, and was put in service recently by that concern.

A feature of the truck, the invention of Walter Moreland, is a compressed air device for loading and unloading the asphaltum and heavy oil. By this means much time is saved in the transportation of the oil and it is especially valuable in handling hot asphaltum. The truck was given severe tests previous to delivery.

WILL USE TRAILERS.

Lowell Transportation Company Adopts Plan for Increasing Efficiency of Its Garfords.

The Automobile Transportation Company, Lowell, Mass., a concern which does a large trucking business within a radius of 100 miles of that city, recently started three Garford five-ton trucks in its service. So successfully have they performed their tasks that the concern has ordered five more of the same make from the R. & L. Company, Boston, Garford distributor.

Trailers will be attached to these vehicles and on reaching Cambridge on the way to Boston, they will be left there to be unloaded and then reloaded, while the trucks will continue to Boston to deliver and load. Then on the return trip the trailers will be picked up at Cambridge and taken back over the road again, so that seven or eight tons will be carried by each machine.

NEW SWINEHART TIRE MANAGER.

Initial Step in Plan to Enlarge the Plant and Prepare for Increased Business.

Clifford B. Myers has been chosen general manager of the Swinehart Tire & Rubber Company, Akron, O., maker of Swinehart tires, to succeed W. W. Wuchter, president of the company, who has for some time acted in this capacity. The change is an initial move toward enlarging the plant and expanding the business generally.

The present plans take into consideration that in the near future the company will build a much larger factory than it now occupies. The site has not been selected, but as the present plant is is in the heart of the city with no vacant space in proximity, property probably will be purchased in the suburbs and eventually the old building will be sold.

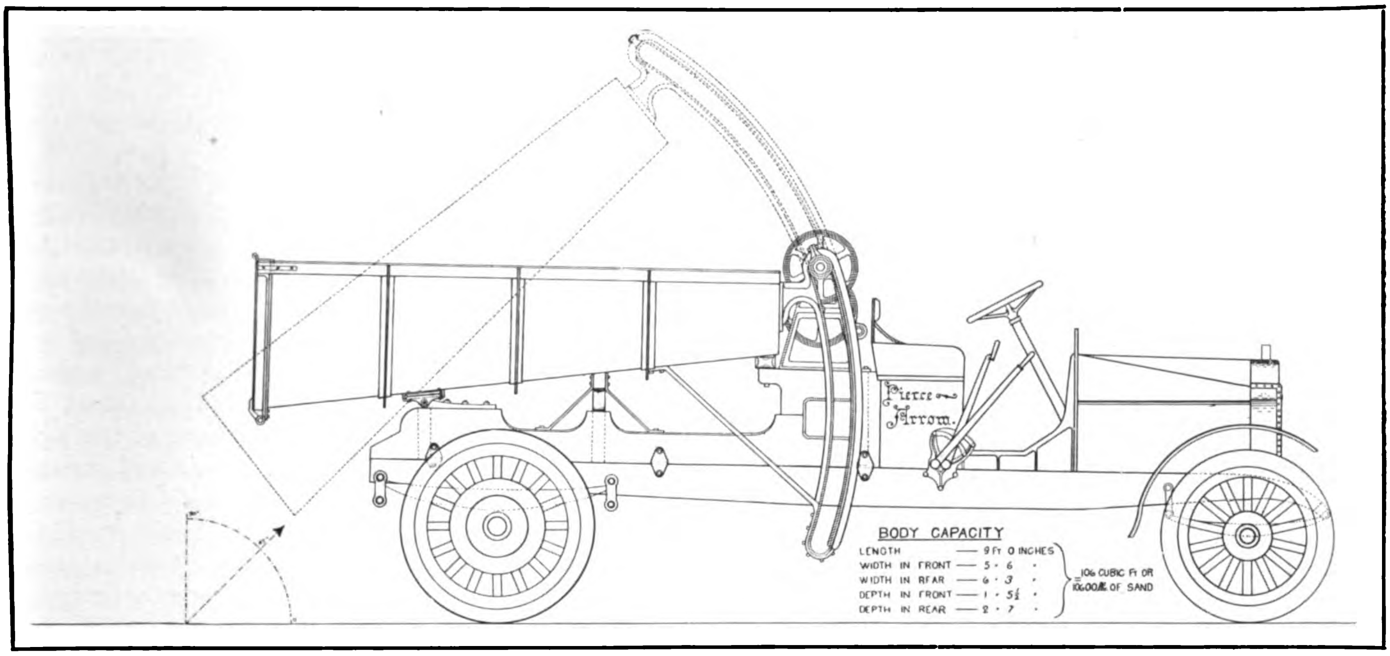
TIME SAVING TRUCK BODY EQUIPMENT.

Special Designs Created to Secure the Economical Loading and Unloading of Freight with Reference to Chassis Construction and Dimensions---Examples of Bodies Intended for General and Specific Haulage.

BODY building with animal service wagons was developed with reference to the use of standardized components. That is, the wheel manufacturers produced sizes of stock to meet actual demands, occasionally making special work to meet unusual requirements. The axles, springs, shafts, poles, etc., were similarly turned out. The principal reason for this was the economy resultant from the establishment of manufacturing on a commercial basis and to meet the competition naturally arising from different business interests active in the same market. Specialization was, as it is now, confined to the higher grades of work, but a very large number were disposed to use what might serve in a general way rather than pay the higher prices necessary in having equipment made to order.

The use of the motor vehicle has necessitated an entirely changed view of the requirements of highway transportation. There are many reasons why this should follow. The one is the general campaign of education for economy that has been developed by all motor wagon interests; the second is the fact that no two chassis manufacturers build with a view of standard body installations; the third, that loads are not carried with reference to distribution of weight on wheels; the fourth, that chassis are not selected with a view of adaptability to body equipment; the fifth, that many owners desire to use their vehicles for several purposes; the sixth, that mechanical features often demand construction that will afford accessibility and minimize the labor of attention and upkeep.

Chassis dimensions are generally determined by the character of the components used by the builder. If the differing elements, the power plant, the clutch, gearset, jackshaft or driving shaft, the radius rods, the axles and the steering gear, all of which must be considered in the length, are made by the manufacturer, he desires to maintain the sizes because his factory facilities must be kept within limitations. If he purchases some or all of his parts the proportions of these are quite as restricting. As material must be contracted for it is not practical to make changes to meet every demand. While it is true that some manufacturers make a number of sizes or types, changes are not made in chassis dimensions as frequently as in arrangement of the parts.



The Monahan Patent Steel Body, Designed for Haulage of Coal, Building and Construction Materials, with Manual Power Hoist.

Chassis length is far easier to adapt than chassis width. Though some of the builders make machines of the same capacity in differing lengths with a view of meeting the various requirements of purchasers, the width is not increased as a rule. Some of the larger machines have treads wider than the standard adopted for vehicles generally, 56 or 56.5 inches, but this does not mean that the chassis is increased in width. The difference is due practically to the wider tires and wheels, and the longer axles, but the distance between the side members of the frame is seldom if ever more than with smaller vehicles.

Then, under ordinary circumstances, it is necessary for the body to be constructed within the limitations of the chassis width. Lengthening is not a serious problem, but increasing the breadth is a subject

The Shadbolt Rear End Dumping Body for General Coal and Material Transportation, an Adaptation of the Animal Equipment.

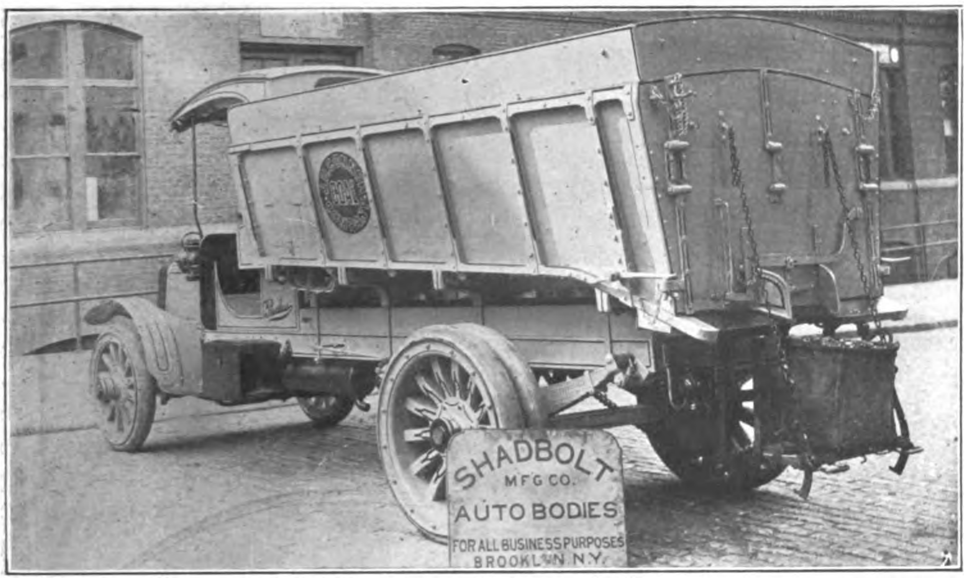
that requires the greatest care and study. The factors may be generally stated to be: First, the necessity of maintaining the centre of gravity as low as is practical; the second, the need of having sufficient elevation of the body to clear the wheels, no matter what the load; the third, the use of large wheels because of the better application of power and the greater economy of tires; the fourth, the character of the load to be carried; the fifth, the necessity of carrying the load as low as is possible; the sixth, the load distribution as required by the chassis design, and seventh, the practicability of insuring even loading.

It is not possible that these requirements will be met by installing bodies of stated dimensions on different chassis. Builders of chassis, especially those who had experience with pleasure car construction, first essayed to make the bodies desired by customers but it was quickly realized that to meet the extremely varied demands would require specialization instead of standard productions, and factory facilities to build whatever was wanted. This experience was repeated with others who have built wagon and truck chassis, and today the majority of machines are bought without bodies. The makers insist that the provisions of the guarantees given purchasers be observed so far as they can be and this is particularly applied to the installation of equipment, especially with reference to distribution of load.

While a number of chassis manufacturers will supply bodies adapted to some general uses, which include what may be regarded as recognized types, a few will sell only completed vehicles, making certain that whatever body is used it will conform to all the engineering requirements of the designs. There are other factors to be considered, however, and one of these is the forms of patent bodies now offered which can be obtained only from the builders, and which have certain advantages that recommend them to those engaged in differing forms of haulage. It would be idle to attempt to even outline the purposes of those who have invented bodies for general and special uses. While there is a limited demand for equipment for but one or several services and there are differing types that will serve the same purpose, it is obvious that the specialty is the more valuable from the fact that a higher price can be obtained, and today there are two classes of body builders—those having specialized products and those who manufacture the standard types of bodies only.

Aside from the problems to be considered with relation to chassis design and construction it is evident that there are other factors no less important—the handling of the loads. Theoretically it would be ideal to have freights so prepared for haulage and such facilities that loading and unloading could be performed in a very brief period of time. With animal vehicles endeavors were made to economize labor by carts and wagons with bodies constructed to be elevated by manual power, they being either balanced or raised by gearings or screw elevators, and discharging the contents by gravity, but time was not so much considered as was the work of the men, for the drivers were expected to at least drive and unload. Some excellent forms were designed for the haulage of coal, sand, gravel, brick and other materials, but no attention was given to loading other than filling carts by gravity from coal pockets and crushed stone bins. With wagons and carts used in construction work loads were frequently dumped through the bottom or from the sides.

The Shadbolt Rear End Dumping Body Drawn Back, as When Unloaded, the Winch and Chains Being Shown.



Rear End Gravity Discharge Coal Truck Body of Shadbolt Design, Adopted for Differing Classes of Use.

Equipping wagons and trucks with quick discharging bodies was merely another utilization of the devices that had been tried and tested on animal vehicles, and naturally enough these led to improvement and development. In the installation of these there is an element of cost that must be considered, and the question that is to be determined is whether or not there is a sufficient saving to justify the expense. By this is meant that if a specific work is to be provided for and a certain number of hauls can be made in a given period, unless the special equipment will save in unloading and loading the time required to make an additional haul, there is no economy. The only manner in which such a special body could be profitable would be in connection with increased speed that would make possible the carrying of an extra load. There would, of course, be lessened work for the driver and crew.

Bodies designed for a certain work are to be preferred to those that are not, although the cost is probably more, but with a builder's knowledge of requirements it is possible to obtain the fullest advantage of mechanical means for elevating and lowering the body, securing means for quickly unloading, and economizing the time of the crew. The manner of loading depends entirely upon the ingenuity of the owner. To illustrate, the use of platforms that will make possible the loading with a minimum of lifting, the use of conveyors, the use of derricks for lifting, the use of crates to prevent articles or material breaking and facilitating handling, the use of pockets or bins for gravity filling, the use of a sufficient area to prevent congestion and consequent loss of time when taking on freight, are all elements that are within his control. In meeting the requirements of those with special work to do the body builder has a problem that is often difficult to solve. If the loads are extremely heavy and not bulky a smaller equipment is advisable for many reasons, but if light and the load capacity of the vehicle is reached, then the matter of centre of gravity and the chassis stresses are to be considered. With the discharge of the loads gravity is largely depended upon, but this is augmented by mechanical means. Several bodies of the character referred to, which are exclusive productions, are examples of developments along practical lines, and have been perfected from knowledge born of actual service.

The first of these is a Pierce-Arrow truck chassis equipped with the Monahan patent dump body, built by the Monahan Vehicle Company, Providence, R. I., which is a steel construction carried on heavy wooden bolsters extending across the chassis frame. The body is built in sizes to carry any commodity or material and as proportioned in the accompanying drawing it has a capacity of five tons. The smallest size is for three tons and the largest thus far produced is eight tons. The purpose of the design is to afford a carrier that is adapted for coal, sand, concrete, gravel, brick, ice or lumber, and the body is built with reference to the weight of the material. For instance, sand will weigh 100 pounds to the cubic foot, and the body may be made with a capacity of 100 cubic feet, if for sand. In a similar manner the weight of any other material may be determined and the desired size of the body found. This, of course, applies to the maximum load.

Folding Shelf, a Feature of the Shadbolt Gravity Discharge Body, Raised to Permit the Helper to Take a Bag from It Without Stooping.

The Eureka Patent Dumping Body, Made by the Lally Commercial Body Company.

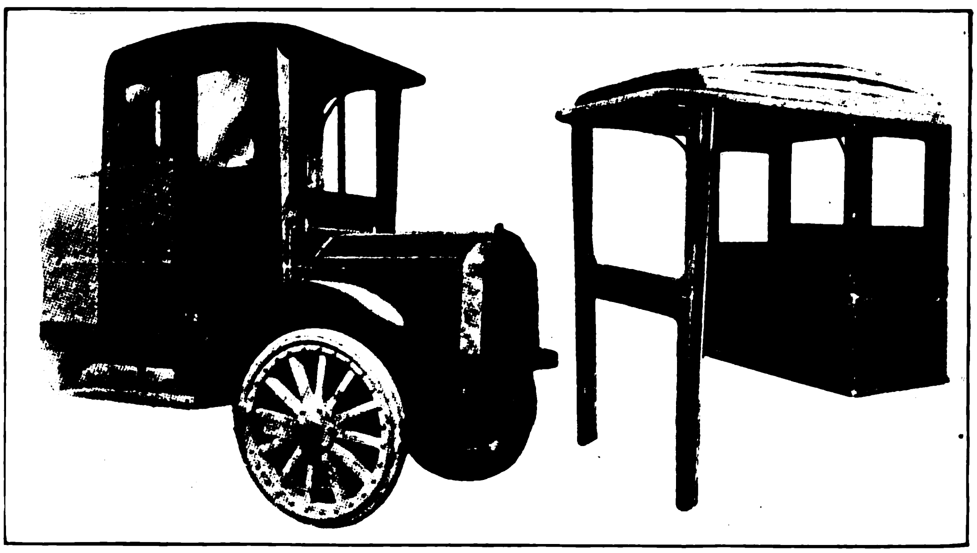
Considering this particular body, it may appear to be shallow, but it is nine feet in length, 66 inches width in front and 75 inches width at the rear, with depth of 17.5 inches at the front and 29 inches at the rear. Because of the overhang at the sides the body is raised to a height that will give ample clearance, and seen from the side the actual capacity is not apparent. With the Pierce-Arrow chassis the weight of the load is carried practically on the rear axle, and the body is carried on the two rear bolsters, which are nearly equidistant from the centre of the rear axles. On the rear bolster are the heavy forged hinges on which the body is moved. The bolsters are attached to the side rails of the cradle that is fitted and clipped to the chassis frame.

The body is constructed of steel plate and it has a frame of five T irons that support the bottom and sides, and the upper edge is strengthened by angle iron straps that are riveted to the T irons. The plates and the frame are hot riveted and the inside of the body is smooth and clear. The tail gate is hinged at the top on a stout round iron rod on which it swings on four hinges. On the bottom of the body are four forged eyes and in these eyes is mounted a heavy rod on which are forged four lugs. One end of the rod is bent at an angle of 90 degrees to form a crank or lever. This is connected with a lever that is held by an adjustable link. Releasing the lever and pulling it backward turns the rod and drops the lugs, and the tail gate is held in place by its weight. The gate may be lifted and dropped on the top of the sides if it is desired that the rear end shall be free.

The body is raised by a shaft carrying two pinions that mesh with two cast steel racks mounted at the forward end and stayed with heavy rods. The racks are in the radius of the lift of the body. The shaft is operated by a double compound series of gears which may be turned by a crank at either side. The body can be lifted to give an angle of 45 degrees inclination to the bottom, which is sufficient for unloading any load, even of concrete or asphalt. The body illustrated was built for a contractor and used largely for building roads. It is given whatever elevation is necessary for distributing the load, either gradually or at once. Two minutes is the longest time required to raise the body and five tons may be handled in that time by a man weighing 125 pounds, but one hand being required to turned the crank. The body is lowered by releasing the ratchet and holding a brake that will regulate the descent.

The Shadbolt Manufacturing Company, Brooklyn, N. Y., produces two bodies that are designed to save labor. The one is a dumping body, constructed of wood, that is mounted on a superstructure or frame that is clipped to the chassis side members. There is a slight inclination to the bottom of the body when ready for loading. On the sills of the body at either side, under the rear half, are heavy steel guides which take the ends of a stout rod extending through the side rails of the superstructure. These guides are formed at the forward ends to endure under a heavy strain. The body can be drawn forward or backward on the frame the length of the guides, chains being connected to a cross shaft carrying a gear at one end, into which meshes a pinion on a countershaft that can be operated by a hand crank. When lowered the body is secured by a latch that is operated by hand. When loaded the body can be unloaded by releasing the latch and drawing the body back on the frame until just past the centre of gravity, when it automatically tilts and the rear end of the body falls until it rests upon the ground. Then by reversing the movement of the hand crank the body is drawn back on the frame and automatically takes a position for loading.

These bodies are constructed of heavy wood frame.



The Star Cab and Storm Front Before Installation and When Ready for Use on a Truck.

panels and floor, and varying sizes, and are often fitted with flareboards to increase the capacity. The tail gate is designed so that it may be opened at top or bottom, or may be removed if desired.

Another body made by the same concern is designed especially for coal haulage. This is a wooden construction of heavy material and it is strongly strapped and braced. It has a rear end gate that may be elevated to any desired height. There is a slight inclination of the body bottom from the front to the rear, and this is increased considerably in angularity near the end gate. The inclined bottom will cause a movement of the coal as the load is removed. There is a small slide with wings at either side in the centre of the gate. The bottom projects for the length of the wings at the small opening, this forming a chute for unloading with bags or baskets. Mounted on the end of the body bottom is a shelf or bench, which is carried on a steel frame that may be adjusted for height, and it may be raised to the height of the body by drawing it straight backward. The shelf is folded against the frame when not in use. When unloading where the coal must be carried in the shelf is dropped. On this a bag or basket may be placed and filled by gravity discharge through the slide opening. Drawing it back will automatically lift the shelf and the bag or basket to a height whence it may be taken by the driver or helper without stooping, lessening the labor decidedly and preventing the coal scattering.

This body is not new, for it has been built for a number of years and in considerable numbers, but it serves a very useful purpose and economizes time and work. It has been used extensively in coal haulage in New York and vicinity. The company builds bodies that are fitted with side gravity discharge and are so constructed that partial loads of both hard and soft coal may be carried and either unloaded with equal celerity. A semi-trailer is another specialty with this firm, this having a capacity of 10 tons of stone, sand, etc., which may be used with a five-ton truck, and another trailer is used for hauling long lumber, and a body is built that is intended for transporting hot asphalt. The engineering department is now developing a demountable body for handling lumber.

The Eureka rear end dumping body, built by the Lally Commercial Body Company, Boston, is raised by manual power. It is mounted on a frame of oak sills and heavy bolsters attached to the chassis frame. This construction carries the load. The body proper has a frame of oak, consisting of sills, posts and top rail, with steel panels and reinforced steel bottom. The tail gate is designed to take out or swing as desired. In the tail gate is a scuttle door for gravity discharge into bags or baskets. The body is hinged on the rear bolster and hinged on the body is a steel frame that slides on two heavy steel members extending between the bolsters. The base of the swinging frame may be moved forward to lift the front end of the body, or backward to lower it, by compound gears and a hand crank. The body can be lifted to an angle of 45 degrees and held in any position by a pawl retained brake. One man can raise a five-ton load in five minutes, and the body may be lowered in five seconds. The construction is with special reference to endurance, all of the forging and fitting being of steel and unusually heavy. The body shown in the illustration, designed for a four-ton load, including all above the chassis, weighs approximately 2000 pounds.

The Acme dumping body, built by this firm, is mounted on a series of bolsters installed on a turntable. It may be raised by manual power to an angle of approximately 45 degrees and the load discharged by gravity from either side or at the rear. Where loads must be delivered in narrow streets and the truck must be drawn beside the sidewalk, gravity discharge may be obtained under practically all conditions.

The company has just perfected a body design that calls for a steel construction throughout. This body is so mounted on the chassis that it may be elevated to a height of nearly six feet at the rear end and to an angle that will permit a discharge by gravity into a chute that may be extended 30 feet across a lawn, over a fence or hedge, and reach a manhole or opening to a coal bin in a basement. The body is constructed so that a lift of the Eureka principle may be used. A five-ton load may be handled very quickly by one man.

The Star Storm Front Company, Troy, O., is building the Star non-racking auto truck top, with removable storm front, which is practically a cab that may be installed on any open truck or wagon, adapting it for use during the winter season. The cab consists of a top that extends over the dash, with sides and back. It is placed on the vehicle, taking the place of the regular seat. The rear window is permanently fixed, but the side windows drop into pockets in the side panels when desired. The storm front or shield is separate from the cab and consists of a frame that will reach from the dash to the front end of the bonnet or hood, with side members that are attached to the dash. A curtain containing two transparent panels fills the frame above the dash, and the open sides may be closed with curtains having one transparent panel each. These curtains are carried on automatic all-metal rollers when not in use. The windows will not admit water and are retained by springs. The entire construction is with a view of endurance and it is firmly secured. The storm front may be removed from the cab in a few minutes' time. The cab is completed with a generous box cushion.

H. H. Lundahl of Walnut Grove, Minn., uses his Reo truck, made by the Reo Motor Truck Company, Lansing, Mich., in hauling milk from his creamery to the railroad and between milking times it is doing the work of three teams about the farm. Recently a part of the land was to be fenced off and the truck carried several loads of fence posts of 256 posts each, many more than could have been carried on one horse drawn wagon. The interesting feature of the truck is the fact that during the service of over a year it has never been laid up for repairs.

EXHIBITORS AT MADISON SQUARE GARDEN.

Business Vehicles.

Alco, American Locomotive Co., New York, N. Y.
Autocar, Autocar Co., Ardmore, Penn.
Buick, Buick Motor Co., Flint, Mich.
Federal, Federal Motor Truck Co., Detroit, Mich.
Garford, Garford Co., Elyria, O.
G. M. C., General Motors Truck Co., Pontiac, Mich.
Gramm, Gramm Motor Truck Co., Lima, O.
Hewitt, International Motors Co., New York, N. Y.
Hupmobile, Hupp Motor Car Co., Detroit, Mich.
Kelly, Kelly-Springfield Motor Truck Co., Springfield, O.
KisselKar, Kissel Motor Car Co., Hartford, Wis.
Knox, Knox Automobile Co., Springfield, Mass.
Locomobile, Locomobile Co. of America, Bridgeport, Conn.
Mack, International Motors Co., New York, N. Y.
Packard, Packard Motor Car Co., Detroit, Mich.
Peerless, Peerless Motor Car Co., Cleveland, O.
Pierce-Arrow, Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Pope-Hartford, Pope Mfg. Co., Hartford, Conn.
Reo, Reo Motor Truck Co., Lansing, Mich.
Saurer, International Motors Co., New York, N. Y.
Selden, Selden Motor Vehicle Co., Rochester, N. Y.
Speedwell, Speedwell Motor Car Co., Dayton, O.
Velie, Velie Motor Vehicle Co., Moline, Ill.
Walter, Walter Motor Truck Co., New York, N. Y.
White, White Co., Cleveland, O.

Pleasure Vehicles.

Alco, American Locomotive Co., New York, N. Y.
Auburn, Auburn Automobile Co., Auburn, Ind.
Buick, Buick Motor Co., Flint, Mich.
Cadillac, Cadillac Motor Car Co., Detroit, Mich.
Cartercar, Cartercar Co., Pontiac, Mich.
Chalmers, Chalmers Motor Co., Detroit, Mich.
Columbia, Columbia Motor Car Co., Hartford, Conn.
Cunningham, Jas. Cunningham, Son & Co., Rochester, N. Y.
Flanders, Flanders Motor Co., Detroit, Mich.
Franklin, H. H. Franklin Mfg. Co., Syracuse, N. Y.
Garford, Garford Co., Elyria, O.
Haynes, Haynes Automobile Co., Kokomo, Ind.
Hudson, Hudson Motor Car Co., Detroit, Mich.
Jackson, Jackson Automobile Co., Jackson, Mich.
Knox, Knox Automobile Co., Springfield, Mass.
Locomobile, Locomobile Co. of America, Bridgeport, Conn.
Lozier, Lozier Motor Co., Detroit, Mich.
Marmon, Nordyke & Marmon Co., Indianapolis, Ind.
Matheson, Matheson Automobile Co., Wilkesbarre, Penn.
Maxwell, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.
Mercer, Mercer Automobile Co., Trenton, N. J.
Mitchell, Mitchell-Lewis Motor Co., Racine, Wis.
Moline, Moline Automobile Co., East Moline, Ill.
Moon, Moon Motor Car Co., St. Louis, Mo.
National, National Motor Vehicle Co., Indianapolis, Ind.
Oakland, Oakland Motor Car Co., Pontiac, Mich.
Oldsmobile, Olds Motor Works, Lansing, Mich.
Overland, Willys-Overland Co., Toledo, O.
Packard, Packard Motor Car Co., Detroit, Mich.
Peerless, Peerless Motor Car Co., Cleveland, O.
Pierce-Arrow, Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Pope-Hartford, Pope Mfg. Co., Hartford, Conn.
Premier, Premier Motor Mfg. Co., Indianapolis, Ind.
Pullman, Pullman Motor Car Co., York, Penn.
Reo, Reo Motor Truck Co., Lansing, Mich.
Selden, Selden Motor Vehicle Co., Rochester, N. Y.
S. G. V., S. G. V. Co., Reading, Penn.
Stearns, F. B. Stearns Co., Cleveland, O.
Stevens-Duryea, Stevens-Duryea Co., Chicopee Falls, Mass.
Stoddard-Dayton, Dayton Motor Car Co., Dayton, O.
Warren, Warren Motor Car Co., Detroit, Mich.
White, White Co., Cleveland, O.
Winton, Winton Motor Carriage Co., Cleveland, O.

Accessories, General Line.

Clucker & Hixson Co., New York, N. Y.
Daniels, Smalley, Detroit, Mich.
Miller, Chas. E., New York, N. Y.
Townsend & Co., S. P., Orange, N. J.

Axles, Transmissions, Etc.

American Ball Bearing Co., Cleveland, O.
Brown-Lipe Gear Co., Syracuse, N. Y.
Cotta Transmission Co., Rockford, Ill.
Hess Spring & Axle Co., Carthage, O.
Lefever Arms Co., Syracuse, N. Y.
Muncie Gear Works, Muncie, Ind.
McCue Company, New York, N. Y.
Sheldon Axle Co., Wilkesbarre, Penn.
Stutz Auto Parts Co., Indianapolis, Ind.
Timken-Detroit Axle Co., Detroit, Mich.
Torbensen Gear & Axle Co., Newark, N. J.
Warner Gear Co., Muncie, Ind.
Weston-Mott Co., Flint, Mich.

Ball and Roller Bearings.

Barthel, Daly & Miller, New York, N. Y.
Bower Roller Bearing Co., Detroit, Mich.
Doehler Die Casting Co., Brooklyn, N. Y.
Hess-Bright Mfg. Co., Philadelphia, Penn.
Hyatt Roller Bearing Co., Newark, N. J.
New Departure Mfg. Co., Bristol, Conn.
Marburg Bros., Inc., New York, N. Y.
Rhineland Machine Works Co., New York, N. Y.
R. I. V. Co., New York, N. Y.
S. K. F. Ball Bearing Co., New York, N. Y.
Standard Roller Bearing Co., Philadelphia, Penn.
Suspension Roller Bearing Co., Sandusky, O.
Timken Roller Bearing Co., Canton, O.

Batteries.

Edison Storage Battery Co., West Orange, N. J.
Electric Storage Battery Co., Philadelphia, Penn.
New York Coil Co., New York, N. Y.
Vesta Accumulator Co., Chicago, Ill.
Willard Storage Battery Co., Cleveland, O.

Bodies.

Budd Mfg. Co., Ed. G., Philadelphia, Penn.
Hayes Mfg. Co., Detroit, Mich.
Springfield Metal Body Co., Springfield, Mass.

Brakes and Brake Linings.

Asbestos & Rubber Works of America, New York, N. Y.
Royal Equipment Co., Bridgeport, Conn.
Standard Woven Fabric Co., Worcester, Mass.

Carburetors and Carbureting Devices.

Byrne, Kingston & Co., Kokomo, Ind.
C. R. G. Mfg. Co., Saugus, Mass.
Fletcher & Co., L. B., New York, N. Y.
Homo Co. of America, Philadelphia, Penn.
International Accessories Mfg. Co., New York, N. Y.
New-Miller Carburetor Co., Indianapolis, Ind.
Royal Equipment Co., Bridgeport, Conn.
Schoen-Jackson Co., Media, Penn.
Stromberg Motor Devices Co., Chicago, Ill.
Wheeler & Schebler, Indianapolis, Ind.

Chains.

Baldwin Chain & Mfg. Co., Worcester, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Co., Philadlephia, Penn.
Sarco Engineering Co., New York, N. Y.
Whitney Mfg. Co., Hartford, Conn.

Consulting Engineer.

Tracy, Joseph, New York, N. Y.

Drop Forgings.

Chicago Drop Forge & Foundry Co., Chicago, Ill.
Cleveland Hardware Co., Cleveland, O.
Western Tool & Forge Co., Brackenridge, Penn.

Fans and Boxes.

Sparks-Withington Co., Jackson, Mich.

Fire Extinguishers.

Pyrene Mfg. Co., New York, N. Y.

Frames.

Smith Co., A. O., Milwaukee, Wis.

Funnels and Cans.

Dover Stamping & Mfg. Co., Cambridge, Mass.

Gasoline and Oil Storage Systems.

American Tank & Pump Co., New York, N. Y.
Bowser & Co., S. F., Fort Wayne, Ind.
Janney, Steinmetz & Co., Philadelphia, Penn.
Wayne Oil Tank & Pump Co., Fort Wayne, Ind.

Horns and Signalling Devices.

Automobile Supply Mfg. Co., Brooklyn, N. Y.
Dean Electric Co., Elyria, O.
Gabriel Horn Mfg. Co., Cleveland, O.
Lovell-McConnell Mfg. Co., Newark, N. J.
Nonpareil Horn Mfg. Co., New York, N. Y.
Piel Co., G., Long Island City, N. Y.
Randall-Faichney Co., Boston, Mass.
Riley-Klotz Mfg. Co., Newark, N. J.

Lamps and Lighting Equipment.

Adams & Westlake Co., Chicago, Ill.
Aristos Co., New York, N. Y.
Badger Brass Mfg. Co., Worcester, Mass.
B. & L. Auto Co., New York, N. Y.
Bijur Motor Lighting Co., New York, N. Y.
Cowles & Co., C., New Haven, Conn.
Dean Electric Co., Elyria, O.
Detroit Electric Appliance Co., Detroit, Mich.
Edmunds & Jones Mfg. Co., Detroit, Mich.
Esterline Co., Lafayette, Ind.
Gray & Davis, Boston, Mass.
Hartford Suspension Co., Jersey City, N. J.
Remy Electric Co., Anderson, Ind.
Rushmore Dynamo Works, Plainfield, N. J.
Splitdorf Electrical Co., Newark, N. J.
U. S. Light & Heating Co., New York, N. Y.
Vesta Accumulator Co., Chicago, Ill.
Ward Leonard Electric Co., Bronxville, N. Y.

Magnetos and Ignition Systems.

Briggs Magneto Co., Elkhart, Ind.
Connecticut Tel. & Elect. Co., Meriden, Conn.
Dean Electric Co., Elyria, O.
General Electric Co., Schenectady, N. Y.
Heinze Electric Co., Lowell, Mass.
Kent Mfg. Works, Atwater, Philadelphia, Penn.
K. W. Ignition Co., Cleveland, O.
Marburg Bros., Inc., New York, N. Y.
Motsinger Devices Co., Lafayette, Ind.
National Coil Co., Lansing, Mich.
Pittsfield Spark Coil Co., Dalton, Mass.
Remy Electric Co., Anderson, Ind.
Simms Magneto Co., New York, N. Y.
Splitdorf Electrical Co., Newark, N. J.
U. S. Light & Heating Co., New York, N. Y

Motors, Electric.
General Electric Co., Schenectady, N. Y.
Motors, Gasoline.
Buda Co., Harvey, Ill.
Model Gas Engine Works, Peru, Ind.
Northway Motor & Mfg. Co., Detroit, Mich.
Warner Mfg. Co., Toledo, O.
Motor Heating Indicator.
Motometer Co., Inc., New York, N. Y.
Mufflers and Cut-Outs.
S. B. R. Specialty Co., East Orange, N. J.
Oils and Greases.
Albany Lubricating Co., New York, N. Y.
Columbia Lubricants Co. of N. Y., New York, N. Y.
Dixon Crucible Co., Joseph, Jersey City, N. J.
Harris Oil Co., A. W., Providence, R. I.
Havoline Oil Co., New York, N. Y.
Haws, George A., New York, N. Y.
International Acheson Graphite Co., Niagara Falls, N. Y.
N. Y. & N. J. Lubricant Co., New York, N. Y.
Sonneborn Sons, L., Inc., New York, N. Y.
Texas Co., New York, N. Y.
Vacuum Oil Co., Rochester, N. Y.
White & Bagley Co., Worcester, Mass.
Wolverine Lubricants Co., New York, N. Y.
Young, Orlando W., Newark, N. J.
Paints and Colors.
Willey Co., C. A., Long Island City, N. Y.
Parts.
Franklin Mfg. Co., H. H., Syracuse, N. Y.
Hess Steel Castings Co., Bridgeton, N. J.
Manufacturers Foundry Co., Waterbury, Conn.
Merchant & Evans Co., Philadelphia, Penn.
National Tube Co., Pittsburg, Penn.
Prosser & Son, Thomas, New York, N. Y.
Piston Rings.
Wasson Piston Ring Co., Hoboken, N. J.
Radiators.
Kells Mfg. Co., W. J., New York, N. Y.
McCord Mfg. Co., Detroit, Mich.
Mayo Mfg. Co., Chicago, Ill.
Shock Absorbers, Bumpers, Etc.
Aristos Co., New York, N. Y.
Blackledge Mfg. Co., John W., Chicago, Ill.
Essex Rubber Co., Trenton, N. J.
Hartford Suspension Co., Jersey City, N. J.
J. M. Shock Absorber Co., Philadelphia, Penn.
Sager & Co., J. H., Rochester, N. Y.
Soaps and Polishes.
Arnold, N. B., Brooklyn, N. Y.
International Metal Polish Co., New York, N. Y.
Stanley, John T., New York, N. Y.
Spark Plugs.
Benford Mfg. Co., Mt. Vernon, N. Y.
Champion Ignition Co., Flint, Mich.
Grossman Co., Emil, New York, N. Y.
Hartford Machine Screw Co., Hartford, Conn.
Mosler & Co., A. R., Mt. Vernon, N. Y.
V-Ray Co., Marshalltown, Ia.
Speedometers and Recorders.
American Taximeter Co., New York, N. Y.
Corbin Screw Corp, New Britain, Conn.
Hoffecker Co., Boston, Mass.
Standard Thermometer Co., Boston, Mass.
Stewart & Clark Mfg. Co., Chicago, Ill.
Service Recorder Co., Cleveland, O.
Veeder Mfg. Co., Hartford, Conn.
Warner Instrument Co., Beloit, Wis.
Springs.
Perfection Spring Co., Cleveland, O.
Starting Devices.
Cox Brass Mfg. Co., Albany, N. Y.
Dean Electric Co., Elyria, O.
Esterline Co., Lafayette, Ind.
Gray & Davis, Inc., Boston, Mass.
Hartford Suspension Co., Jersey City, N. J.
Ignition Starter Co., Detroit, Mich.
Janney, Steinmetz Co., Philadelphia, Penn.
North East Electric Co., Rochester, N. Y.
Remy Electric Co., Anderson, Ind.
U. S. Light & Heating Co., New York, N. Y.
Ward Leonard Electric Co., Bronxville, N. Y.
Steel and Other Metals.
American Bronze Co., Berwin, Penn.
Baldwin Steel Co., New York, N. Y.
Carnegie Steel Co., Pittsburg, Penn.
Carpenter Steel Co., Reading, Penn.
Cramp Ship & Eng. Bldg. Co., Wm., Philadelphia, Penn.
Fischer Steel & Iron Works, Geo., Switzerland.
Light Mfg. & Foundry Co., Pottstown, Penn.
Steering Gears.
Gemmer Mfg. Co., Detroit, Mich.
Lavigne Gear Co., Corliss, Wis.
Ross Gear & Tool Co., Lafayette, Ind.
Steering Wheel Warmer.
Carron & Co., Inc., New York, N. Y.
Taximeters.
American Taximeter Co., New York, N. Y.
Tires, Rims, Etc.
Ajax-Grieb Rubber Co., New York, N. Y.
Batavia Rubber Co., Batavia, N. Y.
Braender Rubber & Tire Co., Rutherford, N. J.
Baker Rim Co., New York, N. Y.
Diamond Rubber Co., Akron, O.
Double Fabric Tire Co., Anderson, Ind.
Endurance Tire & Rubber Co., New York, N. Y.
Englebert Tire Co., New York, N. Y.
Favary Tire & Cushion Co., New York, N. Y.
Federal Rubber Mfg. Co., Cudahy, Wis.
Firestone Tire & Rubber Co., Akron, O.
Fisk Rubber Co., Chicopee Falls, Mass.
General Rim Co., New York, N. Y.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Howe Rubber Co., New Brunswick, N. J.
Kelly-Springfield Tire Co., New York, N. Y.
Lee Tire & Rubber Co., Conshohocken, Penn.
Marathon Tire & Rubber Co., Cuyahoga Falls, O.
Miller Rubber Co., Akron, O.
Motz Tire & Rubber Co., Akron, O.
New Jersey Car Spring & Rubber Co., Jersey City, N. J.
Newmastic Tire Co., New York, N. Y.
Pennsylvania Rubber Co., Jeannette, Penn.
Portage Rubber Co., Barberton, O.
Polack Tyre Co., New York, N. Y.
Republic Rubber Co., Youngstown, O.
Russian Tyre Sales Co., New York, N. Y.
Seamless Rubber Co., New York, N. Y.
Standard Welding Co., Cleveland, O.
Swinehart Tire & Rubber Co., Akron, O.
United Rim Co., Akron, O.
United States Tire Co., New York, N. Y.
Voorhees Rubber Co., Jersey City, N. J.
Walpole Rubber Co., Boston, Mass.
Tire Accessories.
Dykes Co., John G. L., Chicago, Ill.
Essex Rubber Co., Trenton, N. J.
Flex-O-Fill Core Co., New York, N. Y.
Gibney Rubber Co., Jas. L., Philadelphia, Penn.
Gilmer, G. Walker, Jr., Philadelphia, Penn.
Nathan Novelty Mfg. Co., New York, N. Y.
National Rubber Co., St. Louis, Mo.
Tobey, William L., Boston, Mass.
Tire Chains and Protectors.
Federal Chain & Mfg. Co., Springfield, Mass.
Leather Tire Goods Co., Niagara Falls, N. Y.
Weed Chain Tire Grip Co., New York, N. Y.
Tire Pumps and Gauges.
Brown Co., Syracuse, N. Y.
Kellogg Mfg. Co., Rochester, N. Y.
Noera Mfg. Co., Waterbury, Conn.
Schrader's Sons, A., Inc., New York, N. Y.
Stevens & Co., New York, N. Y.
Tire Trunks, Etc.
Ajax Trunk & Sample Case Co., New York, N. Y.
Berg Auto Truck & Specialty Co., New York, N. Y.
Tops and Top Fabrics.
Chase & Co., L. C., Boston, Mass.
Golde-Patent Mfg. Co., New York, N. Y.
Laidlaw, William R., Jr., New York, N. Y.
Mutty Co., L. J., Boston, Mass.
Pantasote Co., New York, N. Y.
Rielly & Son, P., Newark, N. J.
Universal Joints.
Spicer Mfg. Co., Plainfield, N. J.
Varnishes.
Valentine & Co., New York, N. Y.
Voltmeters.
U. S. Gauge Co., New York, N. Y.
Vulcanizers, Etc.
Shaler & Co., C. A., Waupan, Wis.
Tingley & Co., Chas. O., Rahway, N. J.
Windshields.
Cox Brass Mfg. Co., Albany, N. Y.
Metal Stamping Co., Long Island City, N. Y.
Mezger, C. A., Inc., Bronx, N. Y.
Perfecto Wind Deflector Co., Boston, Mass.
Polson Mfg. Co., Buffalo, N. Y.
Wheels.
Jones & Co., Phineas, Newark, N. J.
McCue Co., New York, N. Y.
Schwarz Wheel Co., Philadelphia, Penn.
Sewell Cushion Wheel Co., Detroit, Mich.
Wrenches, Tools, Etc.
Allen Wrench & Tool Co., Providence, R. I.
Coes Wrench Co., Worcester, Mass.
Mossberg Co., Frank, Attleboro, Mass.
Williams & Co., J. H., Brooklyn, N. Y.
Unclassified.
Ashley, James R., New York, N. Y.
Columbia Nut & Bolt Co., Inc., Bridgeport, Conn.
Elliott, H. A., Detroit, Mich.
English & Mersick Co., New Haven, Conn.
Faw, F. W., New York, N. Y.
Gasoline Filter Co., New York, N. Y.
Motor Car Equipment Co., Akron, O.
Non-Skid Mfg. Co., New York, N. Y.
Pioneer Steel Block Tire Co., ———
Rose Mfg. Co., Philadelphia, Penn.
Turner Brass Works, Sycamore, Ill.
United & Globe Rubber Mfg. Co., Trenton, N. J.
Werner, Arthur, Riverdale, N. Y.

EXHIBITORS AT GRAND CENTRAL PALACE.

Electric Commercial Vehicles.

Atlantic, Atlantic Vehicle Co., New York, N. Y.
Baker, Baker Electric Vehicle Co., Cleveland, O.
Buffalo, Buffalo Electric Vehicle Co., Buffalo, N. Y.
G. M. C., General Motors Truck Co., Pontiac, Mich.
G. V., General Vehicle Co., Long Island City, N. Y.
Lansden, Lansden Co., Newark, N. J.
M. & P., M. & P. Electric Vehicle Co., Detroit, Mich.
Ward, Ward Motor Vehicle Co., New York, N. Y.
Waverley, Waverley Co., Indianapolis, Ind.

Gasoline Commercial Vehicles.

Atterbury, Atterbury Motor Car Co., Buffalo, N. Y.
Bessemer, Bessemer Motor Truck Co., Grove City, Penn.
Best, Durant-Dort Carriage Co., Flint, Mich.
Blair, Blair Mfg. Co., Newark, N. J.
Brown, Brown Commercial Car Co., Peru, Ind.
Chase, Chase Motor Truck Co., Syracuse, N. Y.
Dart, Dart Mfg. Co., Waterloo, Ia.
Gramms, B. A., Gramm-Bernstein Co., Lima, O.
Hoosier Limited, Grand Rapids Motor Truck Co., Grand Rapids, Mich.
International, International Harvester Co. of America, Chicago.
Koehler, H. J., Koehler S. G. Co., New York, N. Y.
Krebs, Krebs Commercial Car Co., Clyde, O.
LaFrance, Hydraulic Truck Sales Co., New York, N. Y.
Lauth-Juergens, Lauth-Juergens Motor Car Co., Fremont, O.
Lippard-Stewart, Lippard-Stewart Motor Car Co., Buffalo, N. Y.
MacCarr, MacCarr Co., Allentown, Penn.
Mais, Mais Motor Truck Co., Indianapolis, Ind.
Mercury, Mercury Mfg. Co., Chicago, Ill.
Modern, Bowling Green Motor Car Co., Bowling, Green, O.
Randolph, Randolph Motor Truck Co., Chicago.
Rowe, Rowe Motor Mfg. Co., Coatesville, Penn.
Sanford, Sanford Motor Truck Co., Syracuse, N. Y.
Schacht, Schacht Motor Car Co., Cincinnati, O.
Service, Service Motor Car Co., Wabash, Ind.
Smith, A. O. Smith Co., Milwaukee, Wis.
Standard, Standard Motor Truck Co., Detroit, Mich.
Stegeman, Stegeman Motor Car Co., Milwaukee, Wis.
Sternberg, Sternberg Motor Truck Co., New York, N. Y.
Stewart, Stewart Motor Corp., Buffalo, N. Y.
Studebaker, Studebaker Corp., Detroit, Mich.
Sullivan, Sullivan Motor Car Co., Rochester, N. Y.
Universal, Universal Motor Truck Co., Detroit, Mich.
Webb, Webb Co., Allentown, Penn.

Electric Pleasure Cars.

Buffalo, Buffalo Electric Vehicle Co., Buffalo, N. Y.
Church-Field, Church-Field Motor Co., Sibley, Mich.
Flanders, Flanders Mfg. Co., Pontiac, Mich.
Standard, Standard Electric Car Co., Jackson, Mich.

Gasoline Pleasure Cars.

Abbott-Detroit, Abbott Motor Co., Detroit, Mich.
American, American Motors Co., Indianapolis, Ind.
Atlas, Atlas Motor Car Co., Springfield, Mass.
Bergdoll, Louis J. Bergdoll Motor Co., Philadelphia, Penn.
Case, J. I. Case Threshing Mch. Co., Racine, Wis.
Cole, Cole Motor Car Co., Indianapolis, Ind.
Cutting, Cutting Motor Car Co., Jackson, Mich.
Davis, George W. Davis Carriage Co., Richmond, Ind.
Detroiter, Briggs-Detroiter Co., Detroit, Mich.
Edwards, Edwards Motor Car Co., New York, N. Y.
Empire, Empire Automobile Co., Indianapolis, Ind.
Fiat, Fiat Automobile Co., Poughkeepsie, N. Y.
Firestone-Columbus, Columbus Buggy Co., Columbus, O.
Havers, Havers Motor Car Co., Port Huron, Mich.
Henderson, Henderson Motor Car Co., Indianapolis, Ind.
Herreshoff, Herreshoff Motor Co., Detroit, Mich.
Hupmobile, Hupp Motor Car Co., Detroit, Mich.
Imperial, Imperial Motor Car Co., Jackson, Mich.
Inter-State, Inter-State Automobile Co., Muncie, Ind.
Kline-Kar, Kline Motor Car Corp., Richmond, Va.
K-R-I-T, K-R-I-T Motor Car Co., Detroit, Mich.
Lenox, Lenox Motor Car Co., Boston, Mass.
Little, Republic Motor Co. of New York, New York, N. Y.
Marathon, Marathon Motor Works, Nashville, Tenn.
Marion, Marion Motor Car Co., Indianapolis, Ind.
Metz, Metz Co., Waltham, Mass.
Michigan, Michigan Motor Car Co., Kalamazoo, Mich.
Norwalk, Norwalk Motor Car Co., Martinsburg, W. Va.
Only Car, Only Car Distributing Co., New York, N. Y.
Paige, Paige-Detroit Motor Car Co., Detroit, Mich.
Paterson, W. A. Paterson Co., Flint, Mich.
Pathfinder, Motor Car Mfg. Co., Indianapolis, Ind.
Rambler, Thos. B. Jeffery Co., Kenosha, Wis.
R-C-H, R-C-H Corporation, Detroit, Mich.
Regal, Regal Motor Car Co., Detroit, Mich.
Speedwell, Speedwell Motor Car Co., Dayton, O.
Studebaker, Studebaker Corporation, Detroit, Mich.
Stutz, Ideal Motor Car Co., Indianapolis, Ind.
Velie, Velie Motor Vehicle Co., Moline, Ill.
Westcott, Westcott Motor Car Co., Richmond, Ind.

Motorcycles.

Eagle, American Motor Co., Brockton, Mass.
Emblem, Emblem Mfg. Co., Angola, N. Y.
Excelsior, Excelsior Motor Mfg. & Supply Co., Chicago, Ill.
Flanders, Flanders Mfg. Co., Pontiac, Mich.
Greyhound, Greyhound Motor Co., Buffalo, N. Y.
Harley-Davidson, Harley-Davidson Motor Co., Milwaukee, Wis.
Henderson, Henderson Motorcycle Co., Detroit, Mich.
Indian, Hendee Mfg. Co., Springfield, Mass.
Merkel, Miami Cycle & Mfg. Co., Middletown, O.
Minneapolis, Minneapolis Motorcycle Co., Minneapolis, Minn.
M-M, American Motor Co., Brockton, Mass.
New Era, New Era Auto-Cycle Co., Dayton, O.
Pierce, Pierce Cycle Co., Buffalo, N. Y.
Pope, Pope Mfg. Co., Hartford, Conn.
R-S, Reading Standard Co., Reading, Penn.
Schickel, Schickel Motor Co., Stamford, Conn.
Thor, Aurora Automatic Machinery Co., Chicago, Ill.
Triumph, Triumph Mfg. Co., Detroit, Mich.
Yale, Consolidated Mfg. Co., Toledo, O.

Sidecars.

Baxter, Baxter Side Car Co., Cambridge, Mass.
Majestic, Majestic Mfg. Co., Worcester, Mass.

Accessories, General Line.

Miller, Chas. E., New York, N. Y.

Air Compressors.

Ingersoll Rand Co., New York, N. Y.

Axles, Transmissions, Etc.

McCue Co., Buffalo, N. Y.
Muncie Gear Works, Muncie, Ind.
Timken-Detroit Axle Co., Detroit, Mich.

Ball and Roller Bearings.

Frasse, Peter A., New York, N. Y.
Norma Co. of America, New York, N. Y.
R. I. V. Co., New York, N. Y.
Timken Roller Bearing Co., Canton, O.

Batteries.

Gould Storage Battery Co., New York, N. Y.
Philadelphia Storage Battery Co., Philadelphia, Penn.

Brakes and Brake Linings.

Standard Woven Fabric Co., Worcester, Mass.
Thermoid Rubber Co., Trenton, N. J.

Carburetors and Carbureting Devices.

Homo Co. of America, Philadelphia, Penn.
Schoen-Jackson Co., Media, Penn.
Wheeler & Schebler, Indianapolis, Ind.

Horns and Signalling Devices.

Dean Electric Co., Elyria, O.
Tyer Rubber Co., Andover, Mass.

Lamps and Lighting Equipment.

Dean Electric Co., Elyria, O.
Esterline Co., Lafayette, Ind.
Gray & Davis, Inc., Boston, Mass.
Hartford Suspension Co., Jersey City, N. J.
U. S. Light & Heating Co., New York, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburg, Penn.

Magnetos and Ignition Systems.

Herz & Co., New York, N. Y.
Simms Magneto Co., New York, N. Y.
Splitdorf Electrical Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburg, Penn.

Motorcycle Parts, Etc.

Baker & Co., F. A., New York, N. Y.
Eclipse Machine Co., Elmira, N. Y.

Motors, Electric.

General Electric Co., Schenectady, N. Y.
Westinghouse Elect. & Mfg. Co., East Pittsburg, Penn.

Motors, Gasoline.

Buda Co., Harvey, Ill.
Spacke Machine Co., Indianapolis, Ind.
Warner Mfg. Co., Toledo, O.

Oils and Greases.

Texas Co., New York, N. Y.

Parts.

Hess Steel Castings Co., Bridgeton, N. J.
Warner Gear Co., Muncie, Ind.

Pipe Lining.

American Metal Hose Co., Waterbury, Conn.

Shock Absorbers, Etc.

Flentje, Ernst, Cambridge, Mass.
Hartford Suspension Co., Jersey City, N. J.

Soaps and Polishes.

Baum's Castorine Co., Rome, N. Y.

Spark Plugs.

Herz & Co., New York, N. Y.
Jeffery-Dewitt Co., Detroit, Mich.

Speedometers and Recorders.

Corbin Screw Corporation, New Britain, Conn.
Standard Thermometer Co., Boston, Mass.
Warner Instrument Co., Beloit, Wis.

Starting Devices.

Dean Electric Co., Elyria, O.
Esterline Co., Lafayette, Ind.
Gray & Davis, Inc., Boston, Mass.
Hartford Suspension Co., Jersey City, N. J.
U. S. Light & Heating Co., New York, N. Y.

Steel and Other Metals.

Cramp & Sons Ship & Eng. Bldg. Co., Wm., Philadelphia.
Hoffman Co., George W., New York, N. Y.

Steering Gears.

Ross Gear & Tool Co., Lafayette, Ind.

Tires, Rims, Etc.
American Tire & Rubber Co., Akron, O.
Continental Rubber Works, Erie, Penn.
Newmastic Tire Co., New York, N. Y.
Standard Welding Co., Cleveland, O.

Tire Accessories.
Gray Specialty Co., Newark, N. J.
National Rubber Co., St. Louis, Mo.
Cross & Co., C. J., Philadelphia, Penn.

Tire Pumps and Gauges.
Hawthorne Mfg. Co., Bridgeport, Conn.

Worm Gears.
Cleveland Worm & Gear Co., Cleveland, O.

Unclassified.
Eavenson Sons, Inc., J., Camden, N. J.
Eureka Non-Skid Mfg. Co., Brooklyn, N. Y.
Leeds & Northrup Co., Philadelphia, Penn.
Never Skid Mfg. Co., New York, N. Y.
Rich Tool Co., Chicago, Ill.
Robert, H. T., Chicago, Ill.
Taylor Co., H. D., Brooklyn, N. Y.

EMPLOYS FIFTEEN VEHICLES.

New Haven Transportation Company Satisfactorily Solves Problems of Increasing Business.

The Smedley Company, New Haven, Conn., one of the largest transportation companies in Connecticut, has grown from a very small beginning and two years ago the business had reached such proportions that the transportation problems promised to be of particular annoyance. However, the motor truck was adopted as the solution and today with its fleet of 15 trucks, operating all through the New England states, the company has been enabled to maintain its immense service in an efficient and economical manner and has materially increased its business.

Besides nine small wagons which are used at New Haven for delivering parcels, trunks, etc., the Smedley Company has two 1.5-ton General Vehicle electrics, made by the General Vehicle Company, Long Island City, N. Y.; one 3.5-ton Kelly, made by the Kelly-Springfield Motor Truck Company, Springfield, O.; three Alcos of two, 3.5 and six tons, respectively, made by the American Locomotive Company, New York City. These trucks are constantly on the road, plying between Boston and New York. They have given invaluable service on long hauls and complete satisfaction with the equipment has been expressed by both owner and patron.

MOTOR TRUCK CLUB BREAKFAST.

Entertainment Planned for Industry's Leaders During Progress of Commercial Vehicle Show.

At a recent meeting of the Motor Truck Club of New York City, the following officers were elected: President, D. C. Fenner; vice president, Emerson Brooks; treasurer, C. E. Stone; secretary, E. L. Howland; board of managers, E. W. Curtis, Jr., George H. Duck, Karl L. Frederick, J. W. Perry, A. W. Robinson, W. Oscar Shadbolt and Arthur J. Slade. The selections were unanimous, there being no opposition ticket.

It was provided that no member shall be chosen for the office of president or vice president for two succeeding terms and that the terms be limited to one year. An entertainment in the form of a breakfast will be given to a number of leading men in the industry Jan. 21, during the week of the commercial vehicle show, when an attendance of more than 200 is declared to be assured. Permanent quarters have been taken at George Rector's, 1845 Broadway, and the Motor Truck Club Bulletin, the monthly publication of the organization, has made its initial appearance among the members.

RUSSIA BUYS MORE WHITES.

Repeat Order Held to Be Sequel to Successful Competition in Last Summer's War Trials.

War in Europe has brought business to the White Company, maker of White trucks at Cleveland, O. Word arrived at the factory recently that the Russian government wanted 10 three-ton Whites for immediate delivery. This is held to be a sequel to the peaceful victory of the White last summer in a war department truck competition held in the Czar's dominion, in which nearly every important maker of power wagons in Europe was a contestant against the White Company's product.

Against this sort of competition the American machines won, because the five Whites that started and finished the 1800-mile test did so with no repairs or adjustments being necessary. Examination of working parts developed no wear of any kind. As a result of this, the five White trucks were promptly bought as they stood, that being the only purchase made as a result of the test. The recent order, however, shows in what esteem and confidence the White product is held by the Russian government.

BIG SPEEDOMETER CONCERNS MERGE.

Makers of Stewart and Warner Indicators Combine with Capital of $11,000,000.

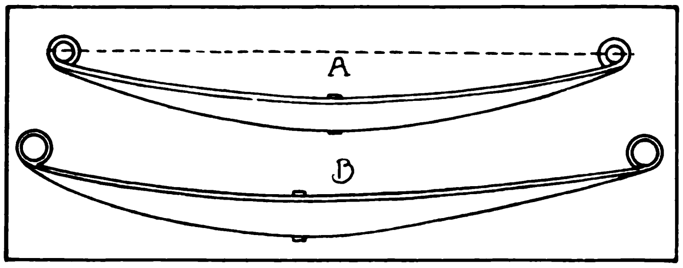
The Stewart-Warner Speedometer Corporation was recently organized under the laws of Virginia with a capital of $11,000,000, taking over the entire stock of the Stewart & Clark Manufacturing Company, Chicago, and the Warner Instrument Company, Beloit, Wis. The new concern will also acquire all of the speedometer patents owned by the Warner Instrument Company, A. P. Warner, C. H. Warner and J. K. Stewart.

The officers, directors and sales forces of the Stewart and Warner companies will remain as before and the product of each factory will be marketed separately. Whiteweld & Co., a New York and Chicago banking house, underwrote the proposition and financed the purchase. J. K. Stewart will be president and C. B. Smith, secretary and treasurer of the new company, the board of directors including representatives of the two old concerns and the banking house.

MOTOR TRUCK SPRINGS AND THEIR WORK.

Differing Designs and Constructions Standard with Vehicle Engineers—Effects of the Tractive Effort and Weight of Loads upon Suspension Members and Provisions for Protecting Them from Abnormal Strain and Wear.

NO PROBLEM that motor vehicle engineers have to deal with is of more importance than suspension. In fact it may be stated that the service and endurance to be obtained, in large measure, depends upon the design and quality of the springs used. It must not be assumed that the ideal has been reached, so far as design is concerned, as practically every form now used has been continued from wagon practise, but the quality of metal has been decidedly improved. Springs were first adapted to vehicles in England late in the first half of the 18th century and their use extended to continental Europe and America. Prior to that time carriage bodies were suspended on straps or links, and gravity was expected to compensate the shocks from inequalities of road surface.



Semi-Elliptic Spring: A with the Centre Bolt Normally Located; B, Centre Bolt Placed Forward of Usual Position, to Give Increased Wheelbase.

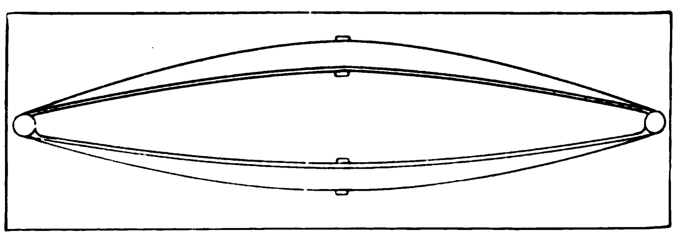
But whatever the form of springs used with animal vehicles two facts are certain: That the carriage or wagon was drawn and the relation of the axles maintained by perches or reaches so that there was comparatively little or no movement. When the first power carriages were built it was easiest for the builders to accept the suspension of the animal vehicle, because there was no experience with the requirements of automobiles or knowledge of the changed conditions that would be met with. It is practise today to follow the design of the construction of the wagon and carriage builders, although it is certain enough that there has not been the advance in suspension that would seem desirable.

There has been a change in the application of springs, this reference being to attaching them below instead of above the axle, but the perch or reach has been given over and radius or torsion rods have been used to preserve the position of the rear axles and the forward springs have been required to endure the stress of driving as well as suspension. In automobile practise A. L. Riker, now vice president and head of the engineering department of the Locomobile Company of America, appears to have been the only designer who gave attention to spring requirements, for he conceived a frame to connect the axles of his early electric carriages and wagons, which was flexible and would permit a vertical movement of both axles and minimize or equalize the driving stresses.

In the present day construction of motor vehicles the body is supported above the front axles by either semi or full elliptical springs. With the former design the "push" of the vehicle is transmitted through the chassis frame to the forward ends of the springs, and there the pivoted connection permits a movement of the spring on a bolt, while the spring pulls or drags the axle. With the latter form the upper half of the spring is connected at the centre to the chassis frame and the force of movement is exerted through the forward ends of both halves to the axle. The rear ends of both halves resist the stresses to a material extent and there is a driving strain proportionate to the distance between the axle and the chassis frame, governed by the speed at which the vehicle is driven. There is a different stress upon the full elliptic than upon the semi-elliptic spring when used on the forward axle of an automobile.

Semi-elliptic, three-quarters elliptic and full elliptic springs are used for rear suspension. When the semi-elliptic type is mounted with a bolt at the forward end, shackled to a spring horn at the rear end, the driving strain is upon the section ahead of the axle, for the rear end is free to move.

Sometimes the front and rear ends are shackled and the drive thrust is taken by the radius rod. When the three-quarter elliptic form is utilized and is similarly shackled at the rear and secured with a bolt at the forward end the driving stress is similarly upon the front half of the lower section. When the full elliptic spring is employed the strain is much the same as has been specified for the forward spring of this type. With pleasure vehicles the practise has usually been to have radius or torsion rods extending from the rear axle to the chassis frame or to the torsion tube housing the driving shaft. In the former instance the driving thrust is taken by the rods and the frame

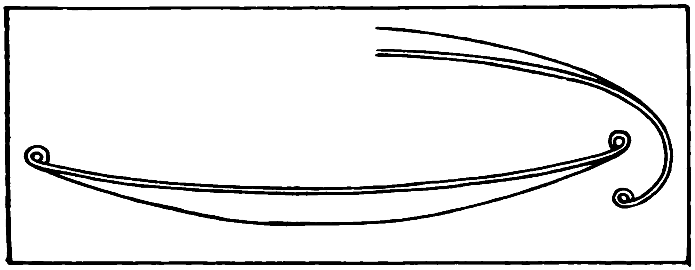


Common Type of Full Elliptic Spring, Generally Used on Light Vehicles.

and springs relieved, while with the latter the torsion tube may be connected with the cross frame member by a yoke, or the tube may be mounted by a globe and

socket secured to a cross member, so that the thrust is borne entirely by the frame.

With designs where the drive is by chains to a dead



Three-Quarters Scroll Elliptic Spring, a Type Not Used on Service Vehicles.

rear axle radius rods are usually installed between the rear axle and the ends of the jackshaft. There are variations of radius rod design and construction, but the principle is practically the same. In some instances these have connection permitting vertical movement of the axle, and in other both vertical and horizontal motion within certain limitations. Usually there is a provision for adjustment in the event of wear. The radius rods are expected to take the thrust of the traction wheels and where the propeller shaft is used, to prevent the thrust causing side pressure leverage on the gears and bearings. With the chain drive the purpose is to relieve the springs.

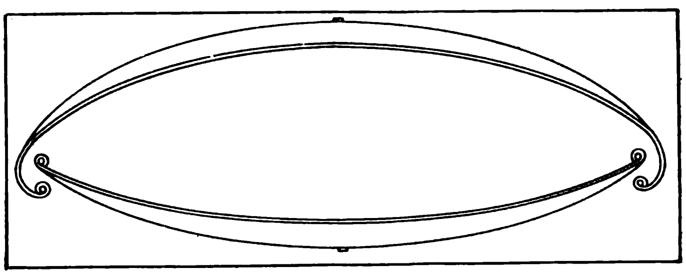
Where radius rods are installed on trucks one end of the spring, and often both ends, is shackled, this design eliminating the strain that would be caused by the forward and backward movement of the axles coincident with its vertical action, this motion resulting from the swinging of the radius rod from the centre of the point of attachment to the frame or jackshaft, and being backward as the spring is compressed and forward as it assumes its natural form. Obviously loading has a tendency to compress the springs and to force the axle backward, but the spring is not seriously affected, though it is not in its precise natural form when carrying the load. The difference, however, is not a matter for serious consideration. This change in the angle of inclination of the radius rod, from the vertical movement of the axle, does have an influence in tire wear, however, from the fact that it intensifies the stress upon the tire and changes the character of the stress with reference to the tractive effort.

In motor truck or wagon construction the drive thrust from the radius rods is taken by the frame, but the entire effort of propulsion forward is exerted upon the springs. It will be seen, however, with the drive transmitted directly to the frame or to the jackshaft, that there are shocks and stresses communicated that cannot be absorbed by the springs, and which the present forms of suspension will not compensate. That is to say, that what the springs would neutralize is taken by the radius rod and the frame and its entire assembly is more or less affected. There is a provision made in the design of the Velie trucks to minimize this effect by using a heavy helical spring that serves as a buffer at the forward end of the radius rods, but it is obvious that where the effects of flexible connection are secured, the advantages of rigidity are sacrificed. In the Eckhard truck design a long rod or tube, the forward end of which is fitted with a heavy buffer spring, connects the forward and rear axles, and this serves much the same purpose as a reach or perch in horse vehicle construction.

There is a turning movement of the rear axle, or at least a tendency of the axle to turn, from the tractive effort, and an opposite effect from the application of the brakes, which is also taken by the springs, and this cannot be compensated. In the Eckhard truck an arm is attached to the rear axle housing and from a cross member is suspended a heavy helical spring, and from this spring a chain is connected to the arm. Any extreme forward turning movement of the axle is checked by the chain and spring, and any shock is compensated to a considerable degree. This device is intended to serve only in the event of tractive effort, however. Reference has been made to these devices to illustrate that these effects have been realized by designers and endeavor has been made to protect the chassis and springs so far as this may be done.

The forward springs are always mounted under the chassis frame. The driving strain with the semi-elliptic form is primarily upon the eye or end of the spring, for the rear end is carried on a shackle, but with the full elliptic type the stress is upon the centre of the spring and upon both eyes. The top leaf of a semi-elliptic spring is known as the "master" and this carries the eyes, which may be formed by turning the ends upward and over, or downward and under, or forged solid. The first construction is regarded as the strongest of the first two, and the last probably the strongest and best. The leaf that extends nearly to the ends of the spring is known as the "long" leaf, and the lowest or smallest the "short" leaf.

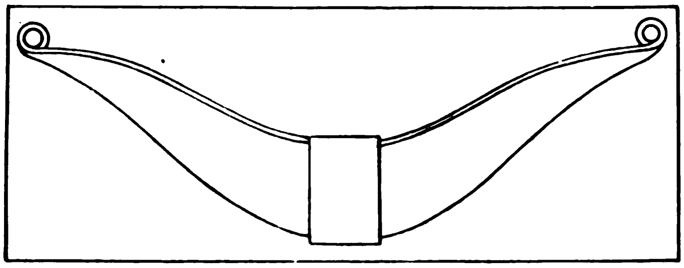
The design of the spring is of great importance, because this determines its efficiency. The type with a large number of thin leaves will be much more resilient than one with a few, and it will endure far longer, because there is not the same degree of stretching and contracting of the metallic fibres. The long spring will have relatively slower vibrations than will the short, and its action will be less violent. The long spring affords the easy riding qualities desired with pleasure



Full Scroll Elliptic Spring, Usually Adapted for Pleasure Motor Cars.

vehicles, and while this is also true of truck springs it is a fact that strength and not extreme resiliency is sought, so that there is not the shock absorbing qual-

ity in a heavy truck spring that would be expected of one designed for a pleasure car. For this reason there is greater vibratory stresses communicated to the



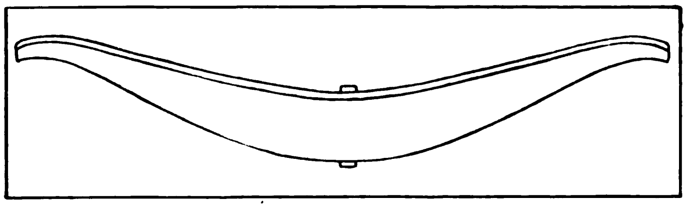
Heavy Semi-Elliptic Spring, Suited for Truck Construction, This Design Having What Is Known as the "Double Sweep" Instead of a Regular Curve.

frame and the components that are mounted in it.

Spring material is usually a specially prepared metal, because it is expected to have unusual elasticity. There is necessarily a limit to the life of metal, but this depends largely upon the elements composing it. The steel formerly used for springs contained perhaps .50 to .75 per cent. of carbon, this combination increasing the tensile strength and giving it an elasticity, but the tensile strength is increased more than the elasticity. Manganese steel has increased tensile strength as compared with carbon steel and is less brittle and less susceptible to crystallization, up to a proportion of about 1 per cent., but a greater volume increases the brittleness until about 10 per cent. or higher percentage is reached, when the metal becomes extremely tough and loses its brittle property.

Nickel steel is generally made with about 3.5 per cent. of nickel in its composition, and this may be regarded as the standard for general purposes. This metal has great wearing qualities and it has great strength and lacks the brittleness of carbon steel of the same strength. Until a few years ago it was used for practically all the purposes for which alloy steels are now utilized. Chrome nickel steel has the qualities of hardness and toughness, being especially adapted for gears and shafts.

Vanadium steel is a combination of vanadium with steel, the general average being .15 to .20 per cent. vanadium. The metal has great toughness, the action of the vanadium being to scavenge the steel of all slags, gases and blow holes that would lessen its value. It may be said that the vanadium purifies the steel and eliminates what would lessen its strength and endurance. Chrome vanadium steel differs from the

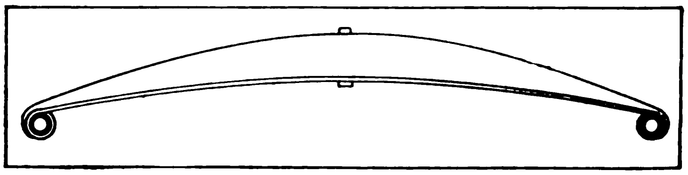


"Double Sweep" Curve Spring as Shaped When Carrying a Load.

vanadium product in that it is harder and has qualities that especially adapt it for many severe requirements, and is much used for springs. Silico-manganese steel has been used for springs and this metal is claimed to have unusual elastic qualities and extreme endurance.

All of these metals, to possess the highest qualities of strength and elasticity, must be "heat treated," which is the term used in the industry to designate what is generally known as "tempering.' In dealing with small parts and pieces of steel it is entirely practical to get every degree of "temper" by cooling or quenching in water and oil and by observation of the colors on a bright surface. But modern "tempering" means that the parts are "quenched" or cooled in water or oil and then heated to a predetermined degree in a furnace, the temperature of which is accurately measured. By this the metal is "drawn" at the point where it will have the required hardness and elasticity.

With springs there is always friction between the leaves proportionate to the work they have to do and their degree of elasticity. When straightened the leaves extend, and contract with the recoil, and no inconsiderable degree of effort is absorbed by this frictional contact. Spring leaves are retained when assembled by a centre bolt, by a special bead in the centre known as the "nib," by a bead that fits into a slot or groove in the plate above, or by lips that project at the sides near the ends and fit about the next longest leaf. These, save the centre bolt, are intended to



Semi-Elliptic Spring Designed for Use as a "Jack" or "Cross" Spring.

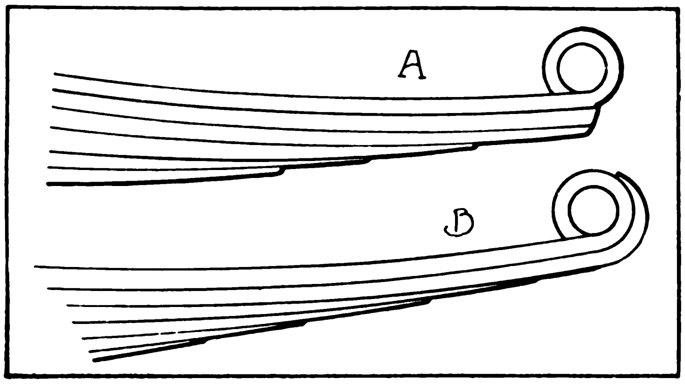
prevent a transverse movement of the leaves and maintain them in proper alignment.

The special value of alloy steel is better resistance against fatigue, or longer life, and increased endurance, but design is the principal factor that makes for ease in riding. When a spring is installed and a weight placed upon it the point at which it is at rest may be termed the load line. It will be deflected below this when the weight in the vehicle is increased, and this line will then become the load or stationary line. When a road obstruction is met the wheel and axle is forced upward and the deflection of the spring increased, or, if a depression should lessen the pressure for an instant the tendency of the spring is to resume the regular line of curvature.

A spring having a regular arc, as a semi-elliptic, is said in engineering phraseology to have a "true curve." If there should be a reverse in the curve, as is sometimes encountered in truck spring design, the spring is known as having a "double sweep." The type where the upper half curves below the lower half and connection is made with a shackle is known as the three-quarter scroll elliptic, as with a half section for the upper half, or a full scroll elliptic, as with a full section for the upper half. These are always used for rear installation with pleasure vehicles. The scroll

springs have usually greater curve than any other form.

The upper leaf of a spring always contains the eye,



Reinforced Springs: A, the Long Leaves Full Length to Support the Master Leaf; B, the Long Leaf "Wrapped" on the Eye of the Master Leaf.

that is, for a semi-elliptic or three-quarters form, and the driving effort is upon or through the upper leaf unless the eye is "wrapped" with the long leaf, or radius rods are used. It will be seen that this brings a strain upon the spring construction that is resisted largely by the clips by which the springs are secured to the axles.

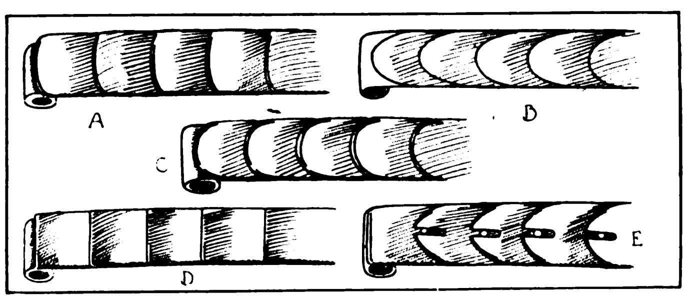
The thrust of driving the machine is always endured by the upper or master leaves of the semi-elliptic springs attached to the front axle, as the front eye is never shackled and is mounted in the spring horn or hanger. Not only this, but the road shocks upon the wheels must eventually be taken by the springs where they are fixed to the chassis frame. The movement of the springs is expected to compensate all the stresses, no matter how violent, and the degree of elasticity must necessarily be given by design, within certain limitations as to size. In design there are the several types stated, and these may vary in degree of arc or curve. In the design of springs the leaves or plates, except the master leaves, are usually thinner at the ends than in the centre, generally tapering gradually, and the ends of the plates may be finished in differing shapes. There is no rule or practise that governs spring plate end shapes. With heavy truck springs, however, the master leaf is often the same thickness of metal from end to end, and in this construction the long leaf is not tapered, so that the next or third leaf is the first tapering member, these two being full length. This gives a slow moving spring.

Springs are designed to have a certain form without load, ar. when loaded the form is changed in proportion to the weight. The effect of a wheel striking an obstruction is to raise it upward, and the spring is bent proportionately to the force. In ratio to the deflection is the reflection, which throws the body upward, and the tendency of the spring is to vibrate several times until the shock is absorbed. But the reflex action carries the wheels and axle upward, so there is not the same weight nor the same tractive effort for a very brief period. This brings another strain upon the spring. As the spring is deflected the pressure upon the leaves maintains their relation with each other to a considerable degree, but the reflection tends to separate the leaves, and to prevent this clips are often used that will permit a longitudinal movement, but will not allow separation. This affords a movement of the spring as a whole and prevents the master leaf enduring the full force of the reflex action. These clips are known as "clinch clips," used with light springs, with merely a sliding movement, and as "special clips," where a bolt or member is fitted with a sleeve, which had a revolving motion and lessens the friction.

The action of the spring that will result in wear is manifested generally at the eyes, and to prevent wear upon these points it is best to bush or line these with a metal that can be replaced when worn. Phosphor bronze, Tobin bronze and steel may be used, but the bronzes are preferred because of their anti-friction qualities, and with such bushings bolts hardened and ground are advised.

After springs have been used and exposed to water there is a probability of the surfaces of the plates in contact becoming rusted, which resists a free action and causes friction and wear. It is possible to introduce lubricant between the leaves by jacking the chassis frame to a point where the spring is relieved of pressure and the leaves slightly separate. Such lubrication is advisable at times and will result in much easier riding. Practically all spring bolts and shackles are now provided with grease cups, generally fitted to hollow bolts, so that the bearing and moving surfaces may be lubricated, and this provision minimizes wear. It is not possible to exclude abrasive substances from the eyes, however, and the best form of protection is to be certain that the bolts and eyes are effectively greased.

All springs are secured to the axles at what is undoubtedly the strongest section, but if a bolt is used to retain the leaves in assembly the members are rigidly maintained at that point and the movement must be at either side, with the strain most severe at the ends of the spring seat. The "nib" is another form of construction, but is not often used. If the spring seat is short the action of the spring is quicker and more pronounced, and the strain is concentrated, but if long



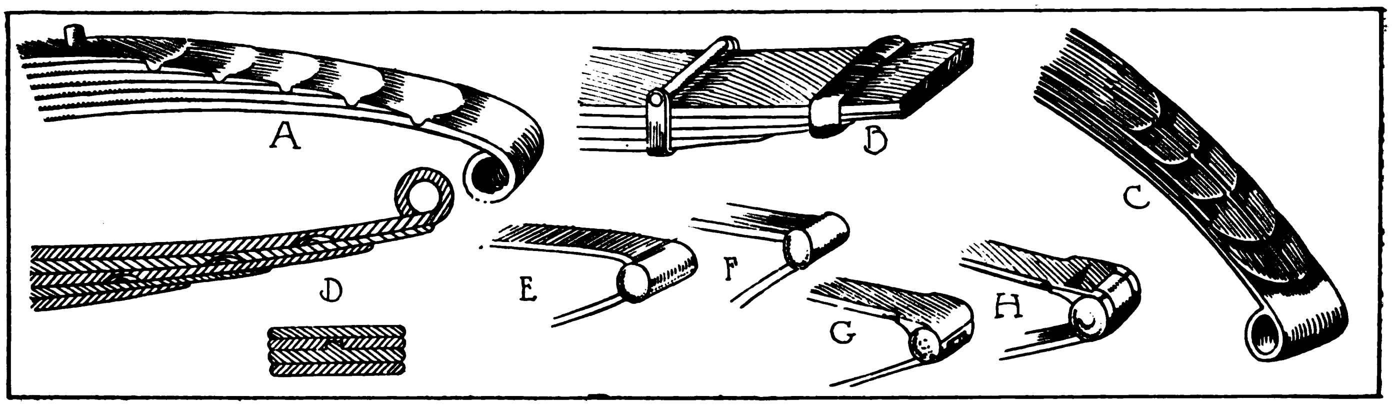
Spring Leaf Ends: A, "Special Round;" B, "Egg Shaped;" C, "Round;" D, "Square;" E, "Slot and Bead."

the action is slower and the spring is "stiff," but the stresses are more distributed. A very general practise is to fasten the springs to the axles by clips at

either side of the axle, with cross members passing under the axle connecting the two clips, secured by nuts. Sometimes a plate is used on top of the spring, through which four bolts are passed and two cross members similarly secured. The clips are usually made of a fine quality of Swedish iron to endure the extreme stresses. In several instances the axles have been drilled and a plate used that is secured as has been stated and by two bolts through the axle. This is not general practise, however.

With pleasure cars shock absorbers are very generally fitted, which resist the extreme movements of the springs and permit the action within limits that are determined by the owner or driver. These may be adjusted for either rough or smooth roads. Manufacturers of service wagons and trucks sometimes fit their machines with somewhat lighter rear springs than would be necessary to carry the full capacity and endure, and supplement these with jack or cross springs that are free and not utilized until a half load or more is carried. These may be in the form of a cross spring that is hung from a cross member, the ends of which contact with "pads" on the axles or incorporated with the spring clip plates, or auxiliary helical springs mounted between the spring clip plate and the chassis frame. The purpose of these is to make an easier "riding" vehicle with a light load and yet have sufficient capacity with a full freight. "Jack springs" are not an uncommon installation on differing sizes of vehicles. Such springs have different work than those which support the vehicle frame and are not subjected to the same stresses.

It will be seen that springs are designed to perform specified work and when a load is not equally distributed, as is frequently the case, there may be a much larger strain upon a spring than has been provided for in the design, and this will account for the "sagging" of springs. It may be noticed that springs will "sag" if required to endure a comparatively light load all the time, and obviously when overloaded service vehicle springs will become distorted. When distortion is noted it is possible to have a spring restored to efficiency by "tempering," which is a work often performed by blacksmiths, but this had best be done by an expert, preferably by the manufacturer.



Methods of Retaining Springs:. A, "Lipped" Spring; B, "Special" or "Roller" and "Clinch" Clips; C, "Ribbed" Spring; D, "Saw and Bead;" E, "Button Head;" F, "Berlin Head;" G, "Closed Open Head;" H, "Open Head."

BOSTON CLUB'S MEETING.

Feature Was Thomas A. Edison's Christmas Tribute to Frank J. Stone.

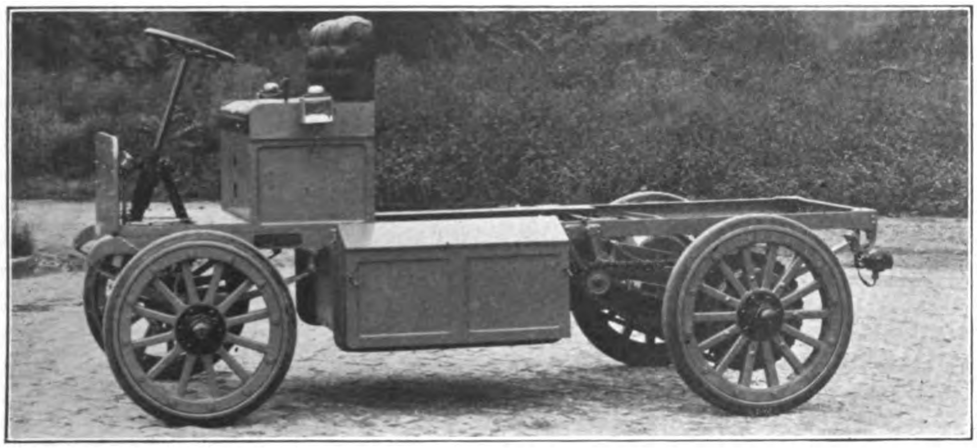
The Electric Motor Car Club of Boston, which includes in its membership the agents for and the dealers in electric pleasure and service vehicles of that city, at its December meeting, took occasion to make the most of the holiday spirit, and there was a Christmas tree from which gifts were distributed to the members, each being bestowed with an appropriate verse. The occasion was one of good fellowship and not the least significant incident was the presentation to Frank J. Stone, manager of the Boston branch of the Electric Storage Battery Company, of a portrait of Thomas A. Edison. Mr. Stone is widely known in the electrical world, and he is chairman of the committee on arbitration of the Electric Motor Car Club.

When it was proposed to present to Mr. Stone in a spirit of holiday merriment a printed picture of the head of a competing firm, and this fact was known to Mr. Edison, he said: "It would give me great pleasure to have Frank Stone know that I appreciate the great work he has done in the advancement of the electric vehicle, and to evidence this by sending him what I consider one of my best portraits, inscribed 'To Frank J. Stone, from Thomas A. Edison.'" The tribute of the great inventor to Mr. Stone's activity in his own field, and the expression of good will and friendship, was keenly realized by the members of the club, and Mr. Stone made appropriate acknowledgment of the gift and the sentiment that it represented.

O. B. Henderson, sales manager of the Baker Motor Vehicle Company, Cleveland, O., after a western trip that brought him in contact with a very large number of agents and representatives of the company, is very confident that the volume of business now in prospect will exceed that of any former year. Observation and information has convinced Mr. Henderson that there is a healthy tone to business and that there will be an extremely active market for both pleasure cars and service wagons. The company has made arrangements to produce a large number of machines.

ATLANTIC ELECTRIC VEHICLES.

THE Atlantic Vehicle Company, with general offices at 1600 Broadway, New York City, and factory at Newark, N. J., builder of Atlantic electric vehicles, devoted a long period of time to designing and developing a line of machines which the maker claims to be superior on design and workmanship to any product offered in the market. The vehicles, in capacities of 2000, 4000, 7000 and 10,000 pounds, are sold with the fullest knowledge of the possibilities for service and the company is confident that the claims made for these vehicles will be realized by the purchasers.



The Chassis of an Atlantic One-Ton Wagon, This Illustrating the General Design and Structural Characteristics.

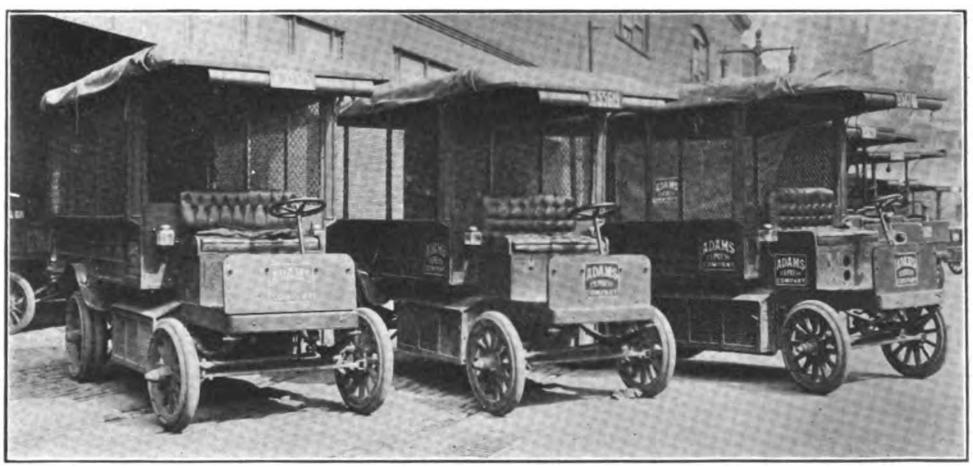
The machines were designed by Arthur J. Slade, the company's engineer, who is regarded as one of the foremost of his profession, who for seven years has made a special study of motor truck design and transportation requirements and needs. He was instructed by the company in undertaking the work to spare no effort in his department, that the machines should be of the highest quality, and it is maintained that the Atlantic chassis are the equal in quality of the very best of chassis for gasoline makes, having to a marked degree that simplicity of design that is to characterize the electric motor vehicle of the future.

In designing the Atlantic chassis it was believed best to have a standard and the different sizes are substantially the same, although they differ in the proportions of the components. No extremely radical or unusual features of design or construction have been incorporated in these vehicles, the purpose being to follow as closely as possible well established and standardized practise, making such improvement as experience had demonstrated it to be necessary or desirable in the proportion and size of parts, quality of material and workmanship. The machines have been designed and built with an ample factor of safety to insure against failure or undue wear for a long period of years when operated under normal service conditions.

The description given may be applied to any of the Atlantic vehicles, as it does not specify dimensions, but gives the general detail of the design.

The motor is built by the leading manufacturer of electric vehicle motors, and is the latest and most improved construction, having been developed with extreme care. It is a four-pole series wound type with a commutator of unusually large area, having low internal resistance and built to take temporary overloads as high as 300 per cent. The armature shaft, of large diameter, is mounted on annular ball bearings. The motor is enclosed in a dust and water tight steel housing, there being a cover that is almost instantly removable and which exposes the commutator. The motor is rigidly suspended by a crucible steel cross member with forged lugs, to which lugs the motor housing is bolted. This cross member is bolted to the chassis frame side members.

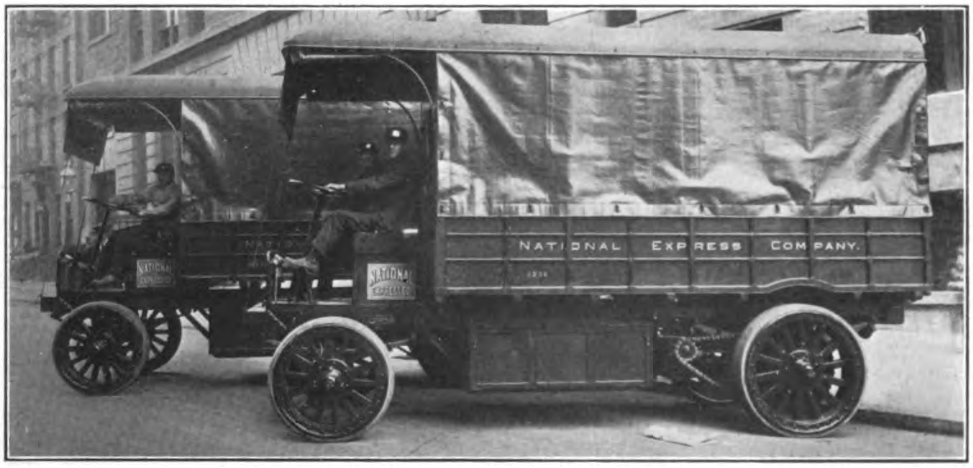
One end of the armature shaft of the motor projects through the housing, and on this is mounted a mild steel sprocket adapted for a silent chain. This chain affords the first reduction and drives the large mild steel sprocket mounted in the differential gear cage or assembly incorporated with the jackshaft. This chain is a Morse product, of wide cross section, and it is enclosed in a housing that is mounted at one end at the motor case and supported at the other by the jackshaft. The chain operates in this case in a bath of lubricant and it is extremely long lived.



Three Atlantic Two-Ton Wagons, Included in the Adams Express Company's Fleet in New York City Service.

The jackshaft is assembled as a unit and it may be

removed or installed as such with comparatively little labor. The differential assembly, of the bevel gear and pinion type, is contained in a cage or housing on which is mounted the differential sprocket. The differential gears and pinions are of 3.5 per cent. nickel steel, carefully heat treated. The differential gears are carried on annular ball bearings of very liberal proportions. The jackshafts are 3.5 per cent. nickel steel, heat treated and are mounted on annular ball bearings at the outboard ends. The jackshaft housing is Shelby steel tube, the inner ends of which are brazed into large malleable iron spiders, and these spiders are with heavy webbed arms that are assembled with large bolts. Integral with the sprocket on the jackshaft differential is a cast drum that is used for a brake. The spiders as assembled afford a support for the forward end of the chain case. The outer ends of the Shelby steel tube are brazed into crucible cast steel members which serve the threefold purpose of supporting the large annular ball bearings on which the shafts revolve, of enduring the thrust of the radius rods connected to them, and carrying the jackshaft.



Two 3.5-Ton Atlantic Trucks with the Standard Service Equipment, Used by the National Express Company.

Each member is bolted to the crucible steel castings that serve as hangers and are hot riveted to the side members of the chassis frame. These hangers support the front shackles of the rear springs. Four bolts support the jackshaft at either end, and by removing these the assembly may be removed from the chassis as a unit after detaching the chain case and loosening the chain.

The chassis frame is built of rolled steel channel section of generous width and depth, the weight and thickness being proportionate to the weight to be carrièd and the span that must support that weight. The members are hot riveted and are securely braced by large gussets. The frame is carried on semi-elliptic springs, constructed of material and proportioned to the demands. This detail has been given careful consideration, as the suspension of a vehicle is of vital importance, as the springs must not only be sufficient to endure under a normal load, but must withstand the road shocks and stresses to which they are subjected under widely differing conditions of operation. The springs must be flexible enough to minimize the vibration resultant from use that is transmitted to the chassis frame and all the moving and working parts, and absorb the shocks that would more or less affect the battery and the different elements of the vehicle. The tests made by the engineering department are claimed by the Atlantic company to have proved the design of the springs in use, and they are made of silico-manganese steel. This material is produced by the Krupp gun works at Essen, Germany, and is imported specially, the springs being made by one of the leading spring manufacturers of this country. The company claims that these springs are the highest priced used by any American truck manufacturer. The design requires a comparatively large number of thin and highly tempered leaves, affording extreme flexibility and great strength. The eyes are fitted with bronze bushings and the shackles are mounted on hardened and ground bolts of large size of a self-lubricating type.

The axles are drop forgings of a high quality of steel, which long experience has proven to be especially suited for the use made of it, the front axle being an I-section and the rear axle a rectangular form. The steering knuckles of the front axle are very heavy and the wheel spindles are large, being fitted with Timken roller bearings. The wheels are built to a design of the company by one of the best known manufacturers of the country. The spokes are rectangular in cross section, with ample support at the hub, and the large size spokes are "flared" at the outer ends, forming a shoulder that gives increased support of the felloe. The wheels are fitted with steel bands or rims that are shrunken on, and as the felloes and rims are made to the S. A. E. standards it is possible to have the wheel stock thoroughly seasoned and the wheels made in advance of requirements. As all of the tires made by leading manufacturers will fit these rims an owner has practically a choice of the products of the market. The wheels are built proportioned to the loads to be carried and take tires that meet with the requirements of the tire manufacturers, so that the owners receive the maximum guarantee of mileage with all shoes made by them. The diameter of the tires is liberal, especially with the large machines, for experience has demonstrated that tire expense with trucks is one of the principal items of operating expense. The front tires for the smaller sizes are 34 inches diameter and 36 rear, and for the larger machines 36 inches front and 40 rear.

The brakes are very carefully designed and have ample power to hold the vehicles under any condition of use. The regular service brake is incorporated in

the jackshaft assembly and it is a contracting band operating on the cast steel drum integral with the differential sprocket. The emergency brake has internal expanding shoes, which operate within the drums of pressed steel bolted to the rear wheels. These drums are large diameter and the brake is very powerful. The contracting band and the brake shoes are faced with anti-friction material and cannot be affected by oil, grease or any abrasive substance, and cannot be burned or destroyed by continual use. Both brakes are operated by pedals located near the base of the steering column, and may be used simultaneously if desired.

The drive from the jackshaft to the rear wheels is through the second reduction or side chains, of an amply proven and generally adopted type, these being driven over crucible cast steel sprockets, the wheel sprockets being bolted to the brake drums. The relation of the rear axle and the jackshaft is preserved by heavy crucible cast steel radius rods that have a radial movement at the rear axle, where bronze bushings are fitted to resist the wear. These bushings may be renewed whenever necessary. The rods are adjustable at the forward ends.

The steering gear is an irreversible worm type with unusually large wearing surfaces in contact, this construction minimizing the degree of wear and lessening the necessity of adjustment. The gear is mounted in a bracket attached to the chassis frame and has an inclination that conveniences handling. The tiebar and drag link, of large size, are carried above the axle and are protected by the axle and the projecting portion of the chassis frame.

The battery is carried in a cradle having a frame of substantial steel angles, with wood floor, sides and ends. The battery is installed at the sides, the panels being quickly removable and permitting the withdrawal of the crates for examination or work. The cradle is built to receive the type of battery selected by the purchaser, either acid or alkali forms, and these will vary with the form decided upon. The power wiring, from the battery to the controller and from the controller to the motor, is of cable of liberal carrying capacity, minimizing the drop in voltage to the lowest practical point, and thoroughly insulated against acid and weather influences. The wiring is well protected against all probable causes for wear or breakage. The controller is a continuous torque type, a product of the General Electric Company, and it has four forward speeds and two in reverse. The contact fingers are very liberal in cross section area of contact so as to endure and to insure long periods of service without renewal. It is possible, however, from the accessibility of the controller, to make such renewal a simple matter when necessary. The controller is operated by a pinion that moves a segment, through a handle projecting through the seat beside the driver, and the movement of the handle is comparatively small to pass from one extreme of action to the other. The controller is housed under the driver's seat.

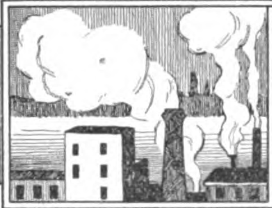
The drive is at the left side, the hand wheel being of large diameter to insure ease in handling under all conditions. The equipment includes a Sangamo ampere-hour meter, a main charging switch, a charging receptacle, two electric dash lamps, electric bell and a kit of tools.

An illustration of the care in designing is seen in the use of manganese steel, heat treated, in forged brake levers, brake shafts, levers, etc., insuring maximum strength and endurance, and in providing all wearing parts not otherwise lubricated with large compression grease cups.

The one-ton machine has a wheelbase of 102 inches and tread of 60, and a loading space of 101 by 60 inches. The normal speed light is 12 miles an hour, and 10 miles loaded. The two-ton wagon has a 114-inch wheelbase and 62-inch tread. The loading space is approximately 126 inches by 60. This vehicle has the same light and loaded speeds of the one-ton. The 3.5-ton truck has a wheelbase of 135 inches and 71-inch tread. The loading space is approximately 144 by 72 inches. The speed is 10 miles an hour light and eight miles loaded. The five-ton truck has a wheelbase of 144 inches and tread of 75, and the loading space is approximately 144 by 72 inches. The speed fixed is nine miles an hour light and seven miles loaded.

Atlantic Five-Ton Truck with Regular Body for Brewery Delivery and the Standard Cab Generally Used in This Service.

Officials of the Brooklyn Navy Yard recently purchased several Garford trucks made by the Garford Company, Elyria, O., which are in daily use handling sand, stone and other materials for pier and construction work in the yard, carrying coal for warships, etc.



BRIEF NEWS OF MANUFACTURER AND THE TRADE

The Van Winkle Motor Truck Company, Atlanta, Ga., has opened a city sales office at 39 Houston street. I. B. Lawton is manager.

The Beaver State Motor Company, recently incorporated to manufacture motor trucks at Portland, Ore., is planning the erection of a factory in the near future.

L. A. Bartlett has become identified with the Universal Motor Truck Company, Chicago, branch of the Universal Motor Truck Company, Detroit, maker of Universal trucks.

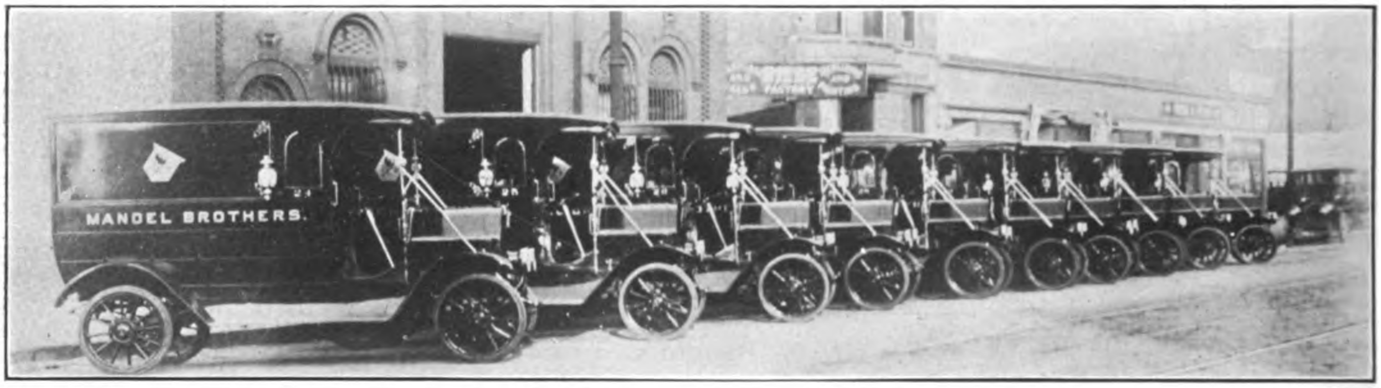
The Motz Tire & Rubber Company has established a branch in Boston, where Motz tires will be distributed. The new establishment is at 4 Dundee street and M. A. Frank is manager.

The I. Sekine Company, 530 Broadway, New York City, recently took the agency for Adams trucks, made by the Adams Bros. Company, Findlay, O., for the Island of Japan.

J. Perkins, for several years superintendent of the Saurer truck factory of the International Motor Company, at Plainfield, N. J., has resigned to become superintendent of the plant of the Rushmore Dynamo Works of Plainfield.

The Olsen & Juergens Company, Chicago, has just been formed to handle Lauth-Juergens trucks, made by the Lauth-Juergens Motor Car Company, Fremont, O. A service station has been opened at 905 West North avenue.

Mandel Bros., Chicago, Ill., has added 10 1000-pound Waverley electric wagons of the shaft driven type, made by the Waverley Company, Indianapolis, Ind., to its delivery service. Five of these vehicles are equipped with batteries capable of giving 60 miles on a charge, and the others have batteries capable of giving 75 to 100 miles. An accompanying illustration shows the new fleet, which was installed in time for the holiday rush.



Fleet of Waverley Electric Wagons Recently Added to the Delivery Equipment of Mandel Bros., Chicago.

P. W. Klinger, formerly connected with the Speedwell Motor Car Company, Dayton, O., maker of Speedwell pleasure cars and trucks, has been relieved of his duties as factory manager and has become chief engineer of the company.

Edward E. Hileman of Newcastle, Penn., has been appointed distributor for the Gramm-Bernstein line, made by the Gramm-Bernstein Company, Lima, O., for Newcastle and vicinity.

Frank B. Hutchinson, Jr., formerly of the Horseless Age and Motor staffs, has been appointed advertising manager for the Kelly-Springfield Motor Truck Company, Springfield, O., maker of Kelly trucks.

Warren T. Walker has been appointed manager of the Boston branch of the Kelly-Springfield Motor Truck Company. He was formerly the Boston representative of the Locomobile Company of America, Bridgeport, Conn., maker of the Locomobile cars.

The Piggins Motor Truck Company, Racine, Wis., maker of Piggins trucks, has established a branch in San Francisco, Cal., to serve as a distributing depot for the entire West, Hawaii and the Orient. J. I. McLaughlin is manager of the branch and will also distribute the Inter-State pleasure cars.

The Cass Motor Truck Company, Port Huron, Mich., maker of Cass trucks, has secured the services of E. J. Farkas, formerly chief engineer of the Cartercar Company, Pontiac, Mich., maker of Cartercars, as consulting engineer.

The Robinson Motor Truck Company, Minneapolis, Minn., has added a new model to its line. It is a four-cycle truck, to be known as the Minneapolis. The machine will be made in 1.5, two and three tons capacity. The company will continue to manufacture the Gopher, fitted with a two-cycle engine.

The General Vehicle Company, Long Island City, N. Y., has been incorporated under the New York laws with an authorized capital of $10,000,000 and will be known in the future as the General Vehicle Company, Inc. Two enlargements to the plant are being made at a cost of about $750,000.

The Chase Motor Truck Company, Syracuse, N. Y., maker of Chase trucks, has established a direct factory branch at Philadelphia. F. B. Porter, who has charge of the New York branch, also is in control of the Philadelphia establishment, which will serve territory in southern New Jersey, eastern Pennsylvania, Delaware, Maryland and the District of Columbia.

The Palmer-Meyer Motor Car Company, 5027 McKessock avenue, St. Louis, Mo., has announced a new 1500-pound truck, which has been thoroughly tested on the roughest roads in Missouri. It is proposed to manufacture 300 of these the first year.

The Standard Motor Truck Company, Detroit, Mich., has started deliveries on the new three-ton truck which the company will manufacture exclusively. While there will be but one chassis this will be made in lengths and with bodies to accommodate the particular line of business in which it is to be used.

The American Motor Fire Apparatus Company, Pittsburg, Penn., recently secured a charter in Dover, Del. The concern has a capital of $1,000,000. It will manufacture all kinds of machinery and motor trucks with fire fighting appliances. The incorporators are P. F. Bitbell, P. S. Chambers, Thomas L. P. Farr.

J. C. Ayres has been appointed manager of the Detroit branch of the General Motors Truck Company, erected at the corner of Lafayette avenue and Fort street. The service department is one of the largest truck garages in the country.

S. G. Chapman, San Francisco dealer for the Hudson cars, made by the Hudson Motor Car Company, Detroit, has taken the agency for the Stewart light delivery truck, made by the Stewart Motor Corporation, Buffalo, N. Y. The Chapman Company is erecting a new establishment which will contain the latest equipment for sales and service for both pleasure and commercial vehicles.

The Alco Pittsburg Sales Company, Pittsburg, Penn., has closed a contract with the Stewart Motor Corporation, Buffalo, N. Y., to handle the Stewart light delivery truck in Pittsburg and vicinity. The Alco Pittsburg concern is a strong organization and has a fine garage and service station.

L. B. Johns has been appointed New England manager of the General Motors Truck Company. He will have under his management the direct factory branch at Boston.

The
MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., FEBRUARY, 1913 No. 2

MANY NEW TRUCKS AT NEW YORK SHOWS.

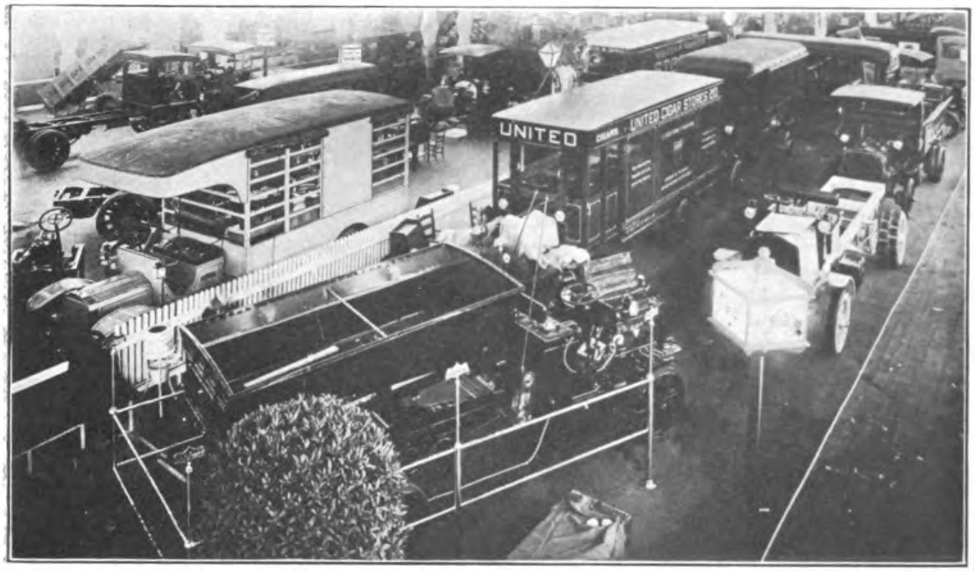
Worm and Concentric Gear Driven Machines Increase in Numbers and Special Attention Is Given to Body and Loading Equipment for Heavy Vehicles---Improved Brake and Spring Design and Heavier Constructions the Features.

NEVER in America was seen as interesting an exhibition of service wagons as that at Madison Square Garden and Grand Central Palace, New York City, from Jan. 20-25, and officially known as Part II of the opening national show of the year. The display attracted many thousands from outside of the city and brought together representatives of practically every concern of importance in the United States, and it was an attraction for engineers from the different factories and the mechanical experts of hundreds now using motor service machines or considering the advisability of using them.

There was a total of 62 exhibitors, but as one maker showed three different makes and another divided exhibits of electric and gasoline machines, there were really 65 separate displays, and the stands showed from one to seven machines. Were one to judge the success of the show from attendance alone the number of visitors might be regarded as disappointing, but when it is understood that comparatively few were attracted from curiosity, and business prompted the inquiries and investigation of those who entered either building, it may be said that the results were particularly gratifying.

Section of the Main Floor, Madison Square Garden, Looking from the Elevated Platform from the Madison Avenue End.

The number who attended the show with a view of making contract for agencies was surprisingly large, and the majority of the exhibitors had to give considerable time to consideration of propositions from those who are desirous of establishing desirable business connections. It is not exaggeration to state that from the agency making aspect the show was extremely productive, while there was a great deal of attention given by business men to examination of types suited to differing forms of haulage. The division of the exhibition between two buildings was in one sense a condition that might be criticised by some, and yet this was not without its benefits, for it influenced more general observation, instead of specific interest in several machines. Madison Square Garden was given over to the makers of wagons who had during the previous week shown pleasure vehicles, and while the number of exhibitors was smaller than at the other section of the show the majority of the exhibits were larger. At Grand Central Palace was seen the greater number of stands and the displays were often of those who had not shown the previous week. The show was opened at 8 in the evening of the first day, and at that time,



Service Wagon Exhibition, Madison Square Garden, Seen from the Elevated Platform from the Fourth Avenue End.

accessibility. There were new machines shown, and some of them admirable examples of engineering, but the majority of the developments of the year were to be seen at Grand Central Palace, where a number of western productions were exhibited for the first time.

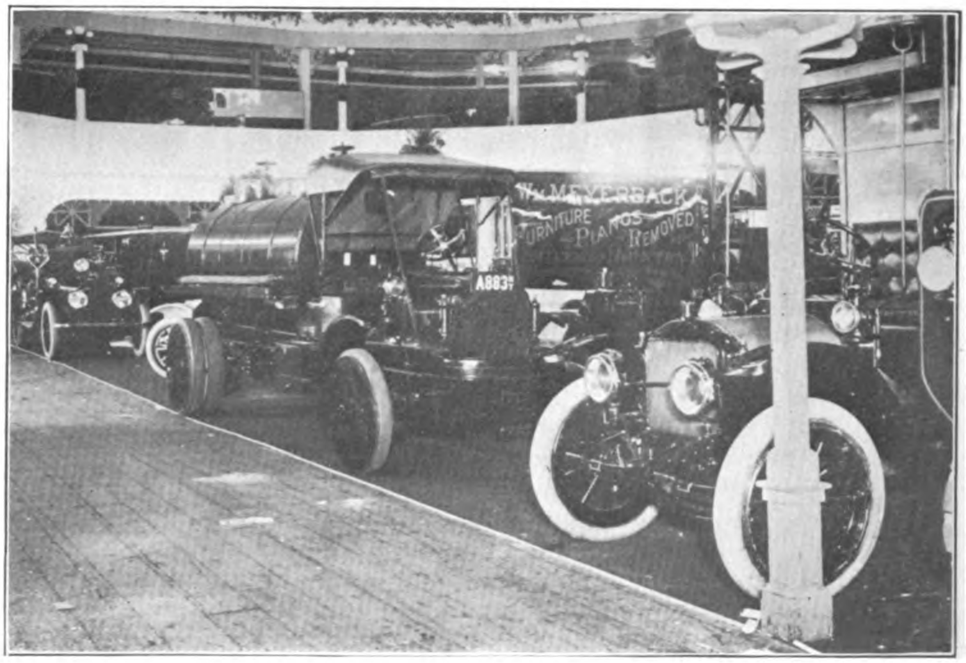
Too much cannot be said of the opportunity for the engineer or the expert to make comparisons of the different designs and types and to observe the constructions to meet needs developed by experience, for if there is one fact more than another emphasized by design it is the need of endurance and a continuance of service. The quality of design from an engineering aspect has become a very important factor, for the large concerns that have need of motor wagons believe that it is wise to depend upon the recommendations of their engineers instead of the judgment of the heads of departments who shall operate them, and this means that the vehicles are subjected to exceedingly careful examinations and judged upon their merits as understood by the men passing upon them. This was also a reason why the presence of capable representatives of the manufacturers, instead of salesmen in the usual sense of selling, played an important part in the results so far as sales were concerned.

While it may be true that personal knowledge of principles of construction may have weight with the man who is purchasing from a fund of engineering data, it is undeniably a fact that the recommendations are made without favor and largely upon the design,

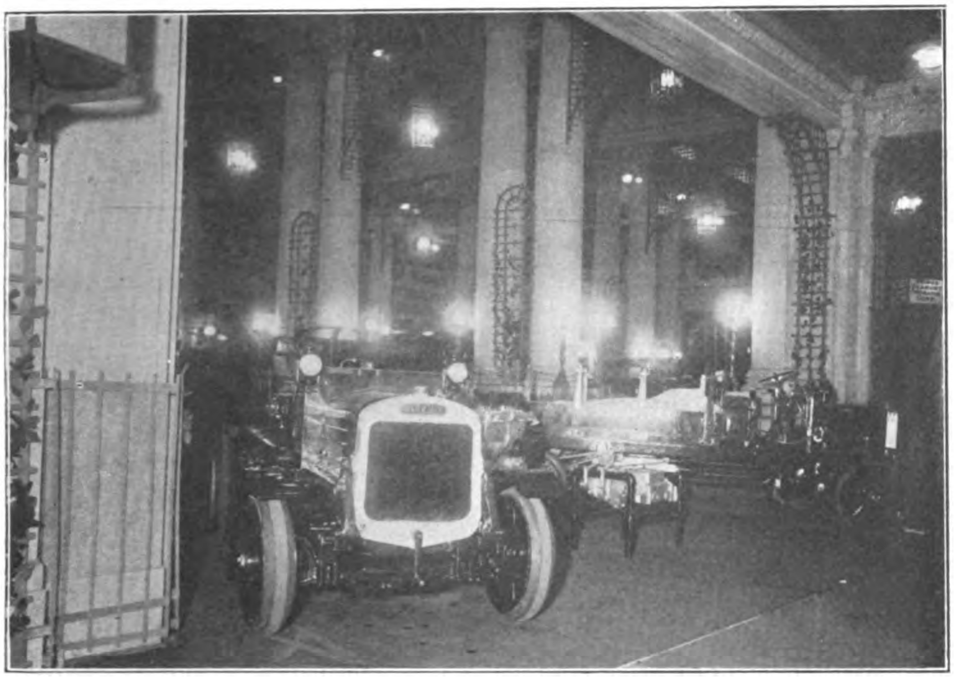
with one or two exceptions, the exhibits were in readiness. There were few changes from the announced list of exhibits. At Madison Square Garden the vehicles filled the main floor and the elevated platform, and the remainder of the space was given over to the accessory, equipment and supply displays, while at Grand Central Palace the main floor was devoted to machines and the third floor to other exhibits, the second or balcony floor, which had been utilized the previous week, being closed.

It is not to be assumed that the exhibitors aside from those who showed vehicles, were satisfied with the results the second week, because there were not the throngs that filled the buildings during the pleasure car show, and it is difficult to trace actual sales made through observation and demonstration. But it was the general belief that with keenly interested visitors there would be results that could not be otherwise than beneficial.

While the exhibitors at Madison Square Garden were chiefly the older and larger builders of wagons, the displays at Grand Central Palace were generally by those not as well known, while there were several who for the first time exhibited at a New York show. The Madison Square Garden displays were decidedly interesting and represented the best productions of the industry, but as a rule the progression evidenced was in perfecting designs that may be regarded as standard. That is, there was comparatively little change, and the endeavors of the designers had been to improve details and insure increased endurance and greater degree of



A Glimpse of the Main Floor of the Truck Show at Madison Square Garden.



Looking Across the Main Floor of Grand Central Palace from the 47th Street Side.

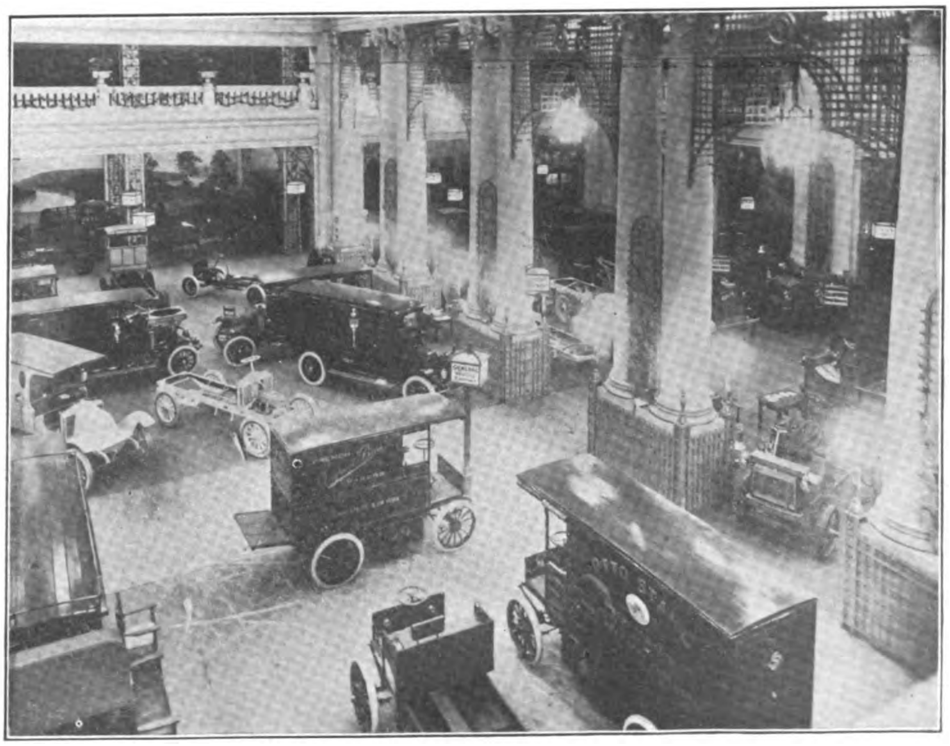
designs and constructions seen for the first time. All of the new electrics, however, were constructed along well defined lines and were in accord with well established principles.

There was undoubted interest manifested in the exhibits of worm driven machines, and there was a decided gain in the number shown, a demonstration that this form of power transmission has appealed strongly to manufacturers. The veteran of the worm drive is the Pierce-Arrow truck, and this year while this was the only vehicle so driven shown at Madison Square, at the other division was seen the Smith-Milwaukee, shown at Chicago in 1912; the Rowe, the Blair, the Universal and the Studebaker one-ton electric, and the Schacht, which was to be exhibited, was not so completed that it could be displayed. The Smith-Milwaukee 6.5-ton worm drive was the largest with this form of transmission shown. Next came the Pierce-Arrow and then the Rowe, Blair and Universal of the gasoline wagons. There was also a considerable gain shown by the users of the internal or concentric gear drive, these being the Mais, the Brown and the new Studebaker. There are three other makers using the internal gear drive and one other electric manufacturer has adopted the worm drive, so it will be seen there is a considerable group that has taken up these

material and workmanship being given equal consideration.

From a mechanical viewpoint the machines were especially interesting. There were few that had made no change whatever in the designs, and with a majority the detail had been given attention to making more uniformly enduring every component subjected to wear or stresses. There has been a very general endeavor to insure lubrication of all wearing parts, and to the strengthening of the components that experience had proven could be improved. This was especially true of the smaller and lighter vehicles, where speed means a maximum of wear from operation, and endurance is as necessary as with the slower and more substantial machines.

The exhibitors at Grand Central Palace included those of electric vehicles, and this division was the largest and best of the kind ever seen in America, although the number of makers was but eight, for all of these build machines ranging from small to large capacities, and suited for all purposes for which this type of wagon is adapted. The majority of those making display did not exhibit a complete line because of lack of space, but there was no question of the engineering, design or construction, nor the possibilities of the different forms of power application. The electric department received a great deal of attention, and there was decided interest manifested in new



Main Floor of Grand Central Palace, Seen from the Balcony on the 46th Street Side.

forms for power transmission. As compared with a year ago there has been a very large gain when indicated by percentage.

There was more that was new and especially interesting to the engineer and the mechanical expert in the constructions seen at Grand Central Palace, but at Madison Square Garden the exhibitors had given the more attention to the demonstration of body construction and equipment to facilitate loading and unloading. Here were shown two forms of trailers, the one being the familiar Martin tractor coupled to a dumping body and to a trailer constructed for the street cleaning department of New York, while a Garford truck adapted as a tractor and equipped with a dumping body of 12 tons capacity, a production of the Shadbolt Manufacturing Company, attracted a deal of interest. The Alco exhibit included a dead wagon fitted with channels to receive the rolls of a removable body, which was adapted for dumping as well as for regular cartage, which construction had been utilized with animal wagons for a number of years, but never before used with trucks.

The Locomobile chassis fitted with a special built lumber body, also a Shadbolt design, which was demonstrated with a new type of dead wagon, and a power hoisting dumping body, were two interesting displays, and the Pierce-Arrow, the White, the G. M. C., the Peerless, a Speedwell truck with a body for sand haulage, were demonstrated with dumping bodies, and all save the last mentioned with power hoist. Of the power pump equipment none attracted more attention than the Pierce-Arrow hydraulic hoist, which is claimed to be unusually efficient.

The display of machine tools for manufacturing and garage purposes was also a feature and excited decided attention from the makers of machines and their engineering staffs.

BECOMES CHIEF ENGINEER.

W. B. Engler Returns from Abroad to Assume Charge of G. M. C. Experimental and Research Work.

Announcement has been made by W. L. Day, vice president of the General Motors Truck Company, Detroit, maker of G. M. C. gasoline and electric vehicles, of the promotion of W. B. Engler to the post of chief engineer with entire charge of experimental and development work. Preparatory to his new and larger responsibilities, Mr. Engler has passed the last three months abroad studying European truck design as well as conditions surrounding truck service and operation in continental cities.

For the past three years Mr. Engler has been head of the engineering department of the General Motors Truck Company's heavy duty gasoline truck plant at Owosso.

The announcement of the appointment of L. N. Harrison as manager of its Chicago branch is made by the Kelly-Springfield Motor Truck Company.

OPPOSE VICIOUS LEGISLATION.

Massachuetts Motor Truck Interests Organize to Fight Pending Measures.

A committee consisting of J. S. Hathaway, J. T. Sullivan, J. B. Sullivan, James Fortesque, William H. Bain, John H. Duffell and J. Porter Russell has been appointed as a result of a meeting of representatives of the motor truck and motor car industries, and users of service wagons especially, held at Boston to plan systematic opposition to pending or prospective legislation, particularly a bill that proposes to limit weight of vehicle, weight of load, speed and fix the width of tires of large trucks.

The measure specified is similar to one that was introduced in the legislature a year ago and referred to the present session. It has been claimed by those who favor the bill that the lack of strength of small bridges necessitates the limitation of the weights they should be subjected to.

LEAVES HESS-BRIGHT CONCERN.

Henry Hess Sells Stock to German Company and F. E. Bright Succeeds to Presidency.

F. E. Bright has become president of the Hess-Bright Manufacturing Company, following the purchase of all the stock owned by Henry Hess, by the Deutsche Waffen & Munitions Fabriken, Berlin, Germany, maker of D. W. F. ball bearings. He was formerly vice president and treasurer and now holds the controlling interest.

A. T. Bruegal is secretary and C. L. McCalla is treasurer of the concern. The German parent factory is being enlarged and extensive improvements to the American plant are being made.

ADDS STILL ANOTHER BUILDING.

Willard Storage Battery Company Planning for Largely Increased Demand for LBA Batteries.

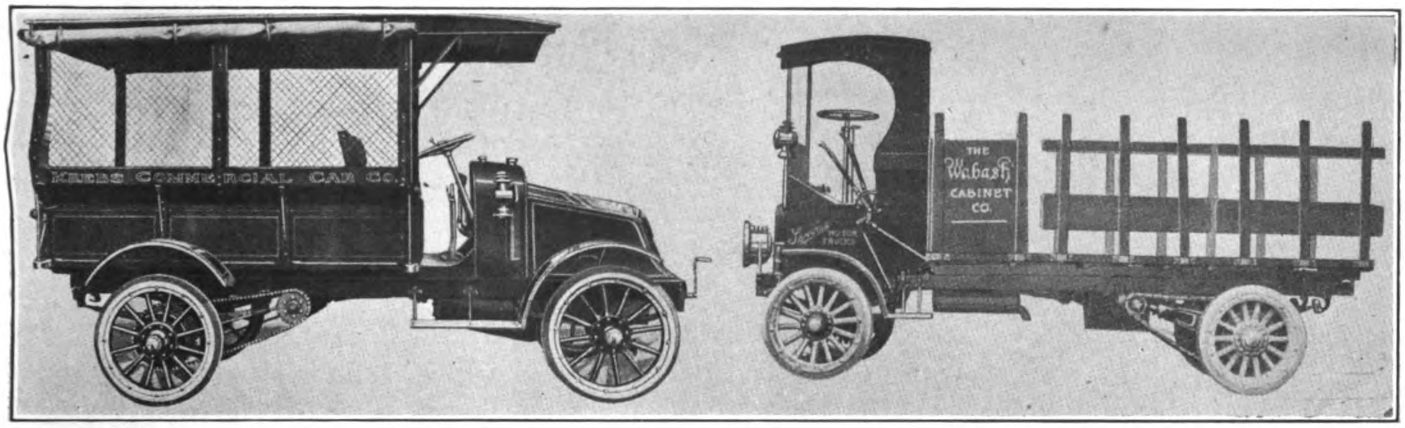
The Willard Storage Battery Company, Cleveland, O., maker of LBA batteries, recently purchased property adjoining its plant No. 1, affording 50,000 feet of additional manufacturing space. Since that time the company has also purchased the plant adjoining the recent addition, a building of brick and steel with 32,-500 feet of floor space.

This furnished the Willard Storage Battery Company with four separate and distinct plants, all conveniently located close together, but not connected. Three are individually equipped for the manufacture of storage batteries and the most recent purchase is intended for future expansion. It will be used for storage purposes only for the present, but when occasion demands it will be equipped for the manufacture of batteries.

NEW MODELS OF WAGONS AND TRUCKS.

Latest Developments of Service Machines Shown at Madison Square and Grand Central Palace--Improvement of Standard Types and Conventional Practise the Feature of the Vehicles Exhibited for the First Time.

AT THE show a number of new machines were seen for the first time, and many of these were particularly interesting. Some were different sizes of designs that are well known, and others were distinctly original. In several instances not a change of any kind was to be noted and with several others the refinements were of so trifling a character as to be hardly worthy of attention, but some productions were in every way interesting from the manner in which the designers had worked out the different problems they met with. It may be said that there is no disposition with men of experience to secure minimum weight at the expense of strength, and yet some of the engineers are emphatic in statements that they have been able to add to the endurance and expected longevity of their creations by the use of carefully selected metals, and elimination of weight where this could be done without lessening the stability of the constructions.



The Krebs Model D Ton Delivery Wagon. The Three-Ton Friction Drive Service Truck.

Krebs in Three Capacities.

The Krebs Commercial Car Company, Clyde, O., showed at Grand Central Palace three delivery wagons, these being models A, B and D. Model B has 1500 pounds capacity, model A 2000 and model D 3000. Model B is shaft and models A and D are chain driven. With these distinctions the brief descriptions will be applied to the two types of chassis as represented by models B and D, but models A and B have a two-cylinder, two-cycle motor and model D has a four-cylinder, four-cycle motor. Model B will be first considered.

This has a motor with 4.5 inches bore and five inches stroke and a horsepower rating of 24.3. The cooling is by thermo-syphon circulation of water through a vertical tube radiator located in front of the dash, and a fan driven by a flat belt from a pulley carried on the crankshaft extension back of the engine case. The ignition is by a Bosch high-tension magneto driven by a cross shaft mounted in front of the motor. The carburetor is an automatic float feed type.

The motor is governed by the Krebs governor, which is mounted at the front of the engine and is driven by the same cross shaft that drives the magneto. This governor is operated by a flexible shaft from the left front wheel and it is maintained that it is in every way automatic and that it can be set to any position, controlling the spark advance as well as the fuel supply, and while it may be set for any desired result it is operated by a lever carried on the steering wheel so that any speed may be had up to the maximum by this control. The governor is usually set for 20 miles an hour for the shaft driven machines and 15 miles for the chain driven. By the control lever both spark and throttle are adjusted to a point where the most efficient work can be done by the engine. It is maintained that with this governor the wagon cannot be made to coast at a rate that would exceed a mile an hour, the speed required to climb the same hill it is descending. When the clutch is engaged the throttle is open sufficiently to maintain a desired speed and when the clutch is disengaged the governor shuts off the gas and the engine cannot race. When the motor is stopped the throttle is open and there is a charge of gas in the cylinder in readiness for starting. To remove the power plant four bolts are taken from the front cross member of the frame and four more bolts from the engine hanger. The motor is carried under a hood of the Renault type.

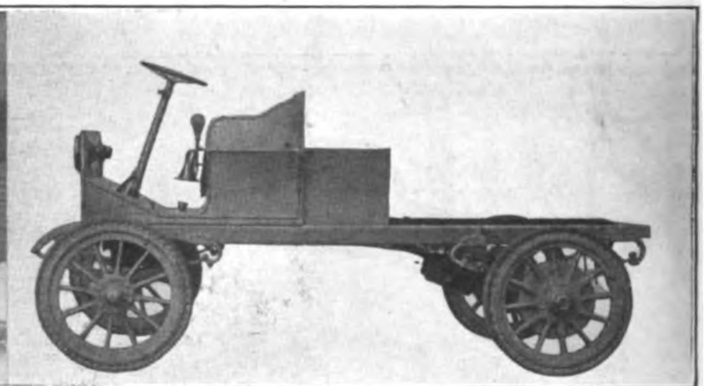
Continuing with model B, the transmission gearset is a Brown-Lipe construction with three forward speeds and reverse, with the control levers at the centre. The drive is by shaft, having two universal joints to a full floating rear axle fitted with New Departure annular ball bearings. The frame is a pressed steel

channel section four inches width and two inches depth, .1875 inch thickness. The springs are semi-elliptic, 40 inches length forward and 50 inches length rear, two inches width. The forward axle is a drop forged steel I section 1.75 by 2.625 inches. The wheels are 34 inches diameter, shod with four-inch pneumatic tires. The drive is left side and the steering gear is an irreversible worm and nut type. The brakes are internal expanding, operating within drums on the rear wheels.

Model A differs from this construction in that it has a rectangular drop forged rear axle 1.75 by 2.25 inches and a jackshaft with drive by side chains and is fitted with three-inch solid tires. Both have a gasoline capacity of 13 gallons, the tank being built in the dash.

Model D has a Rutenber four-cylinder, four-cycle, water-cooled motor with bore of 3.75 inches and stroke of 5.25 inches and is rated at 30 horsepower by the maker. The motor is similarly governed and it is fitted with an electric starter. The transmission gearset of selective type has three forward speeds and reverse. The front axle is a drop forged I section 1.75 by three inches and the rear axle is two by 2.75 inches. The frame is a steel channel section five inches width and it is carried on the same length springs, 2.25 inches width, with .75-inch spring bolts, and auxiliary springs are fitted. The wheels are 36 inches diameter and are fitted with 3.5-inch solid tires forward and four-inch tires at the rear. The wheelbase of models A and B is 100 inches and of model D 115 inches.

The Indiana Two-Ton Wagon.



The Lansden One-Ton Direct Drive Electric Wagon.

Service Three-Ton Truck.

The Service Motor Car Company, Wabash, Ind., exhibited a three-ton truck known as model H, which followed the general design of the smaller machines, this having heavier parts and the proportions being larger. A feature of this construction is the double balanced friction drive. Several improvements have been made in the design, which include adjustable brackets for the jackshaft sprockets, heavier springs, the use of rods instead of cable for brake operation, and the use of roller bearings in the wheels.

Indiana Wagons and Trucks.

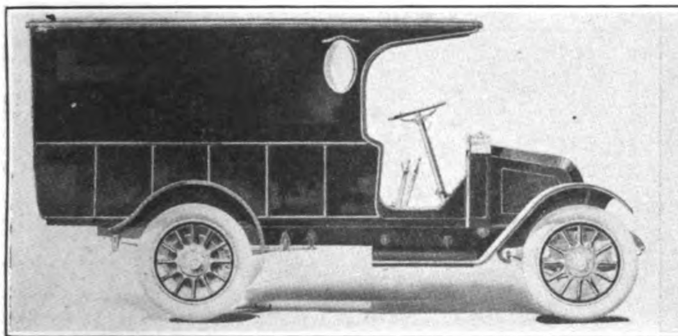
The Indiana wagons and trucks, built by the Harwood-Barley Manufacturing Company, Marion, Ind., which last year showed a 3000-pound wagon at Chicago, were seen at Grand Central Palace, a 1, 1.5-ton and a three-ton chassis being displayed. A two-ton chassis is also built. These constructions follow conventional design. The smallest size is equipped with a Rutenber motor with bore and stroke of four inches, and the ignition is by a Bosch dual system with fixed spark. The clutch is a Hele-Shaw and the transmission gearset is assembled with the jackshaft, it having three forward speeds and reverse, with shafts and gears of nickel steel, the gears having very wide faces. The shafts are mounted on Hyatt roller bearings. The jackshaft is a semi-floating type with shafts of nickel steel. By removing the top or bottom of the housing the differential can be taken out. The drive is by chains to the rear wheels. The frame is a steel channel section five inches width and the forward cross member forms a bumper in front of the radiator. The springs are semi-elliptic, 40 inches length forward and 50 inches length rear, 2.25 inches width. The forward axle is an I section of drop forged steel and the rear axle is a rectangular drop forging. The wheels are 34 inches diameter and are shod with 3.5-inch tires forward and four-inch tires at the rear. The service brake operates on the jackshaft and the emergency brake on the 14-inch drums on the rear wheels. The drive is at the right side with the control levers in the centre. The wheelbase is 135 inches.

The three-ton chassis has a Rutenber motor with bore of 4.75 inches and stroke of five inches and the ignition is by a Bosch dual system. The transmission gearset has Timken roller bearings and the jackshaft is a full floating type with removable shafts of chrome vanadium steel. The differential ends of the shafts are squared and the outer ends have flanges to which the sprockets are bolted. The differential is fitted with a locking device by which the differential may be locked on low or reverse, but automatically unlocks with the shifting of the gears. The frame is a chrome vanadium steel channel section six inches width and it is carried on semi-elliptic springs 40 inches length forward and 50 inches length rear, three inches width. The front axle is an I section 2.25 by 3.25 inches and the rear axle a rectangle 2.75 by four inches. The forward wheels are 36 inches with five-inch tires, and the rear wheels are 40 inches with four-inch dual tires. The wheelbase is 163 inches. The service brake oper-

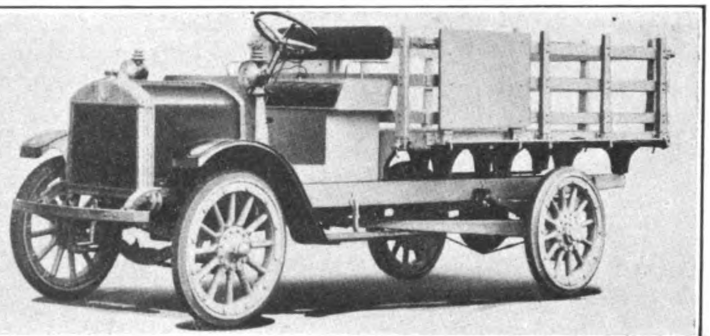
ates on the jackshaft and the emergency brake on 16-inch drums on the rear wheels. The drive is from the right side and the control levers are in the centre. The two-ton chassis differs slightly from this, having a Rutenber motor with bore of 4.125 inches and stroke of 5.25, and has a Bosch dual ignition system with fixed spark and an independent battery system as well. In other respects it is similar save in size of parts.

New Lansden Designs.

The Lansden Company, Newark, N. J., showed a ful line of its machines, these including an ambulance, a 1000-pound express wagon, a one-ton covered express wagon, a 1.5-ton express wagon, a two-ton express wagon and a special one-ton emergency wagon built for the Consolidated Gas Company, which was arranged with a special tool tray under the floor. The machines were all Lansden 1913 types, which design has been described previously, save a one-ton express wagon, which was fitted with the Lansden direct drive. In this the motor is assembled with the full floating rear axle and the drive is by enclosed gears to the differential bevel gear. The power unit is suspended on three points and is well protected against road shocks. The battery is mounted upon the chassis frame under and behind the seat and is easily accessible. The standard battery equipment is 50 type A-4 Edison cells, having a mileage of 50 and a speed of 15 miles an hour maximum.



The Lippard-Stewart Delivery Wagon.



The Universal One-Ton Worm Driven Wagon.

Features of Lippard-Stewart.

Several refinements have been made in the Lippard-Stewart delivery wagons, displayed at Grand Central Palace, one of which is the installation of the steering column with a clamp that firmly secures it to the chassis frame, this preventing the vibration of the steering column and the attendant wear. Some remarkably fine examples of body work were included in the vehicles shown, one of which was an undertaker's wagon, which was fitted with removable side panels and windows, so that with the panels in place it was an unusually ornate casket wagon, and with the windows installed it was converted into a handsome hearse. The change could be made in a very brief period. In addition the platform or bottom of the vehicle was fitted with ornamental metal stops to fit various sizes of caskets, and a roll at the rear permitted the easy movement of a casket either in or out. The interior of the body was handsomely finished in bright mahogany and silver and was lighted by an electric dome light. The line is made by the Lippard-Stewart Motor Car Company, Buffalo, N. Y.

Worm Driven Universal.

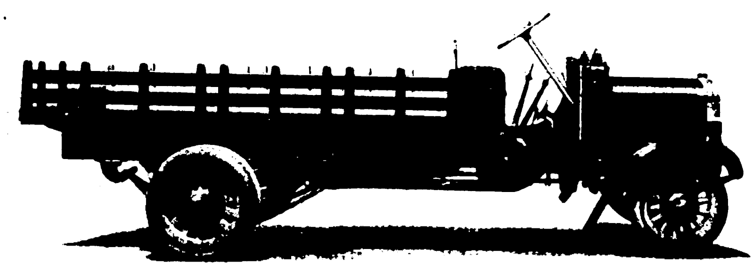
The feature of the exhibit by the Universal Motor Truck Company, Detroit, Mich., at Grand Central Palace, was the one-ton worm driven delivery wagon, which has a wheelbase of 130 inches and a loading space of 120 inches. The construction is in every way conventional, with a four-cylinder, L head, water-cooled motor, with the cylinders cast en bloc, with bore of 3.75 inches and stroke of 5.25 inches, and rated at 30 horsepower. The engine is cooled by a thermo-syphon water circulation through a vertical tube spiral fin radiator, and by a fan driven by a flat belt. The motor is lubricated by a constant level splash system and the ignition is dual, by magneto and battery. The carburetor is an automatic float feed type with a warm air intake. The motor is governed to a speed of 15 miles an hour. The clutch is a single dry plate type and transmission gearset is a sliding gear selective design, giving three forward speeds and reverse. The entire power plant is assembled as a unit and is suspended at three points. The driving shaft operates a worm gear that is assembled with the differential in the full floating rear axle. The frame is a steel channel section six inches width and it is carried on vanadium steel springs 38 inches length forward and 48 inches length rear, 2.5 inches width. The front axle is an I section. The wheels are 24 inches diameter, shod with 3.5-inch solid tires forward and five-inch solid tires rear. The drive is left side and the steering gear is an irreversible worm and block type. The control levers are located at the centre. The service and emergency brakes are internal expanding in drums on the rear wheels.

Interesting Vulcan Line.

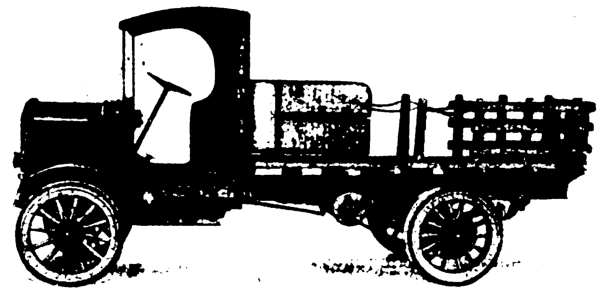
The Vulcan trucks, built by the Driggs-Seabury Ordnance Corporation, Sharon, Penn., were shown for the first time at Grand Central Palace. Of these the 4.5-ton truck was practically the Commer design, but the seven-ton chassis is an entirely new construction. It is a design developed for very heavy work and it is built to have exceedingly long life. The Vulcan chassis are now produced in three, four, 4.5, five, six and seven-ton capacities, but of these the five and six-ton sizes have not been offered for sale, while it is proposed to add to these one and two-ton delivery wag-

ons, which will be ready for the market about April 1. The Driggs-Seabury Ordnance Corporation built many of the components for the American maker of Commer chassis, and these designs have been substantially continued from the three to six-ton sizes, but the ratings of capacity have been reduced and changes have been made that will materially increase the efficiency of the machines. The seven-ton Vulcan has been carefully thought out and it has very large factors of safety throughout.

The motor is a four-cylinder, L head, water-cooled type with the cylinders cast in pairs with bore of 4.75 inches and stroke of 5.5 inches. The S. A. E. rating is 36.1 horsepower. The crankshaft is mounted on three annular ball bearings. The cooling is very efficient, the system having a capacity of 18 gallons of water, which is circulated through the engine by a centrifugal pump, the radiator being either tubular or cellular mounted on trunnions on the chassis frame. The radiation is promoted by a belt driven fan. The lubrication is by a combination of force feed by a gear driven pump and splash. The ignition is by a Bosch dual system, using magneto and battery. It has a carburetor of the automatic float feed type.



The Vulcan Seven-Ton Truck.



The Reo 3000-4000 Pound Delivery Wagon.

The clutch is a leather faced cone and the transmission gearset is assembled as a unit with the jackshaft and is contained in a case carried on three points of support on two frame cross members. The gearset has four forward speeds and reverse and the large shafts and gears are mounted on annular ball bearings. The differential is fitted with a lock. The drive from the jackshaft to the rear wheels is by side chains. The frame is a steel channel section nine inches width and 2.5 inches depth, and is mounted on semi-elliptic springs 48 inches length forward and 55 inches length rear, the rear springs being underslung and having 22 leaves. The front axle is a drop forged alloy steel I section, and the rear axle is a nickel steel drop forging. The wheels are 36 inches diameter with seven-inch front tires and six-inch dual rear tires. The drive is right side and the steering gear is an irreversible worm type. The service brake operates on the jackshaft and the emergency brake on the rear wheel. The wheelbase is 156 inches and the tread is 60 inches forward and 70 inches rear.

New Reo Delivery Wagon.

The new Reo 3000-4000 pound delivery wagon, built by the Reo Motor Car Company, Lansing, Mich., was shown at Madison Square Garden. There are some novel and interesting features of this design, chief of which is the sectional radiator. This is tubular and is made in 24 sections, so arranged that one or more may be removed and the machine used with efficient radiation. The motor is four-cylinder and water-cooled with valves in the side and head and the cylinders are cast in pairs. The bore is four inches and the stroke 4.5 inches. The crankcase is a single casting of aluminum, carrying three main bearings that are adjustable from the outside. The crankshaft is large and of manganese steel. The exhaust valves are in the sides and the intake valves are in the heads of the cylinders.

The motor is cooled by a circulation of water by a gear driven pump, with a belt driven fan and a fan-spoked flywheel. The lubrication is a combination splash and force feed, the bearings being flooded by a plunger pump and splash supplying the other moving parts. The excess from the constant level of oil is drained to the reservoir, filtered and again used. The carburetor is an automatic float feed type with hot air intake, adjustable from the dash. The ignition is by a low-tension magneto and auxiliary battery system. The clutch is a multiple dry disc design, the discs being faced with anti-friction material, contained in a dust tight housing. The clutch shaft is coupled with two universal joints between the clutch and the gearset. The gearset is a selective type, having three forward speeds and reverse, the shifting mechanism being entirely enclosed. The shafts are mounted on Timken and Hyatt bearings. The drive is through a shaft having two universal joints and by side chains. The differential is a four-pinion construction. The frame is a steel channel section 5.5 inches width and the springs are semi-elliptic, 44.5 inches length and 2.25 inches width forward and 42 inches length and 2.5 inches width rear. The front axle is a round steel section and the rear axle is a hammered forging, both fitted with Timken bearings. The wheels are 36 inches diameter with four-inch tires forward and three-inch dual tires rear. The wheelbase is 130 inches. The steering gear is a bevel pinion and sector type. The drive is at the left side and the control levers are in the centre, with spark and throttle levers mounted on the steering column. The motor is governed by a hydraulic governor to 12 miles an hour. The brakes are external contracting, with bands two inches width,

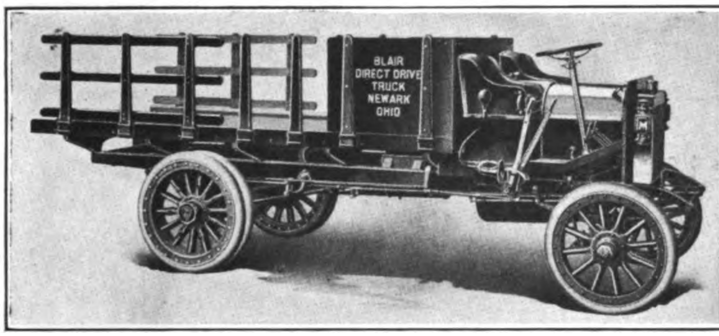
acting on 12-inch drums on the jackshaft and 17-inch drums on the rear wheels.

Blair Worm Driven Models.

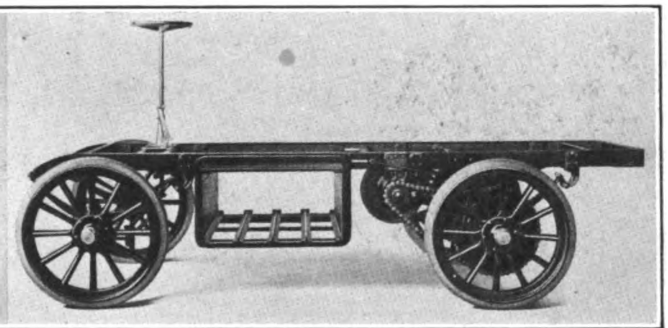
The Blair Manufacturing Company, Newark, O., which exhibited at Chicago a year ago, and which at that time displayed chassis of 1.5, 2.5 and 3.5 tons capacity, showed three chassis of these types at Grand Central Palace, there being no change whatever in the design. The machines are worm driven and differ from any other construction in that a sub-frame of heavy channel steel extends the full length between the two axles. The forward cross member of the chassis frame is very heavy and to this member the sub-frame is hinged or coupled by cast steel brackets and large hardened pins.

The sub-frame is cambered or "necked" back of a large cross member, and at the rear are two more members that carry collars that are fitted to a heavy sleeve that extends at either side and at right angles to the rear axle housing. This sleeve contains the worm. The collars supporting the sub-frame on this sleeve are free to turn, but have no longitudinal motion. Radius rods extend from the ends of the rear axle housing to the centre cross member of the sub-frame, and the tractive effort is transmitted through the sub-frame from the rear axle to the front cross member of the chassis frame. In the sub-frame is mounted the motor and clutch, and the transmission gearset is carried in a heavy case suspended in the sub-frame, with a universal joint in the driving shaft between the clutch and gearset, and a second universal joint in the shaft back of the central cross member of the sub-frame. The rear axle is a full floating construction with a heavy housing, and the chassis frame is suspended on a platform of springs and no matter what the position of the axle through variance of the road surface no excess stress is brought upon the frame or the power plant and the system of transmission, and there is always the same position of the shaft with relation to the motor and gearset.

In other respects conventional design is followed. The motors are four-cylinder, L head, water-cooled types with long stroke, large bearings and enclosed mechanism, fitted with governors, and with dual Bosch ignition. The oiling system is automatic and is claimed to be sufficient for 500 miles. The clutch is a cone with cork inserts and the gearset is selective, having three forward speeds and reverse, the gears being always in mesh and idle only on direct drive. The steering gear is an irreversible construction and all adjustments may be made by turning a single nut at the head of the housing. The radiator is a honeycomb type and is protected by suspension on springs. Both sets of brakes are contracting on the drums on the rear wheels. The seats are on either side of the motor and the drive is at the right side. All the moving parts are provided with means for adequate lubrication. The company is now building a five-ton machine from the same design as the smaller types.



The Blair (Direct Drive) Worm Driven Truck.



The Ward Type ED 8000-Pound Electric Truck.

Ward Electric Line.

The Ward Motor Vehicle Company, New York City, showed at Grand Central Palace four chassis, of 1000, 2000, 4000 and 8000 pounds capacity, of standard design. These machines are entirely conventional, having single motors mounted transversely over the rear axles, with drive by silent chain to a jackshaft and then by chains to the rear wheels. The frames are heavy pressed steel and are mounted on semi-elliptic springs. The axles are rectangular sections, drop forged, fitted with Timken bearings. The batteries are carried in underslung cradles that will take several types of battery. The controllers are a continuous torque design, having four forward speeds and two in reverse. The two brakes are external contracting and are equalized.

The Chase Model M.

The model M Chase delivery wagon, with capacity of 500 pounds, was shown for the first time at Grand Central Palace, though it was placed in the market a number of months before the exhibition. This was the cheapest machine shown and it follows very generally the design of the large Chase constructions. It has a two-cylinder, two-cycle motor with bore of 4.125 inches and stroke of four inches and is rated at 12 horsepower. Like all Chase engines it is air cooled. The lubrication is by mixing the oil with the fuel and the ignition is by a high-tension magneto with fixed spark. The transmission is a planetary type, giving two forward speeds and reverse, and the mechanism is operated in a bath of oil. The drive is to a jackshaft and by double side chains to the rear axles. The frame is of wood and is carried on full elliptic springs forward and a cross spring at the rear that is mounted on extensions of the radius rods. The axles are rectangular, the front being 1.25 inches and the rear 1.375 inches square. The wheels are 36 inches diameter and the

solid tires two inches width. The wheelbase is 84 inches. The control is by a throttle lever on the steering column, the service brake by the right pedal, the reverse the centre pedal, the low speed the left pedal and a hand lever for the high speed. The duplex type brake operates on the rear wheels.

Changes in Stegeman Line.

One of the interesting changes made in the Stegeman chassis, shown at Grand Central Palace by the Stegeman Motor Car Company, Milwaukee, Wis., is the use of a pressed steel chain case that serves as a radius rod. The case is in two parts, the cover is aluminum. In previous constructions an aluminum case was used. The case is built so that the main section carries the expanding brake shoes and at the forward end it is mounted on the jackshaft housing on an eccentric spherical bearing, so that it is free to move and may be adjusted by the eccentric to compensate for wear of the chain. At the rear end the case is carried on a heavy bushing fitted to the axle that compensates for any rotating movement caused by spring action. The case is dust and oil tight and the rear sprockets move in a bath of oil. The frames of these chassis are vanadium steel and extreme strength and lightness are claimed for them. A refinement is an accelerator that may be set or instantly released by a transverse movement of a small foot lever.

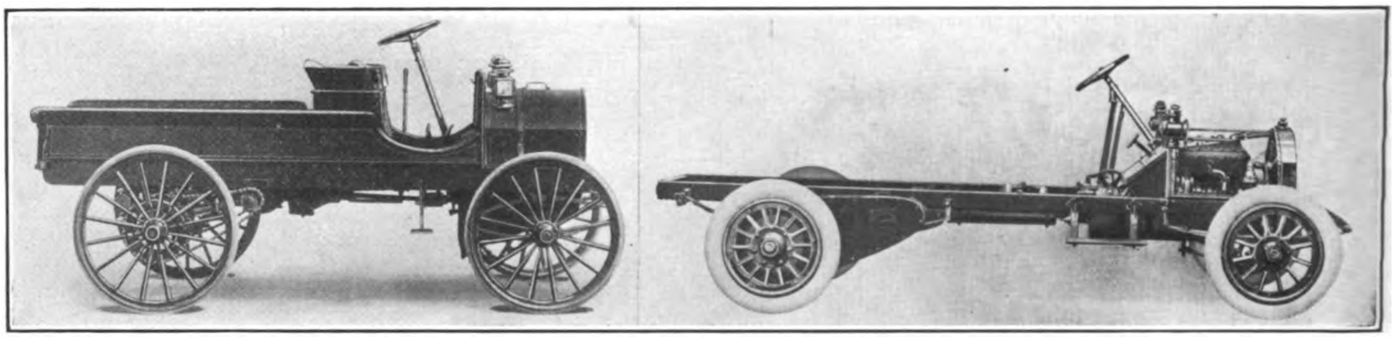
New Atterbury Model.

The Atterbury model A, a chassis with capacity of 1500 pounds, was exhibited at Grand Central Palace, and this was one of the latest of the productions utilizing the concentric gearing or internal gear drive. The maker had made no announcement relative to the machine and its advent created not a little attention. The chassis has a wheelbase of 118 inches and standard tread, and it is claimed that it is unusually heavily built for a machine of its capacity, being constructed to give fast delivery and have extreme endurance.

The motor is a four-cylinder, four-cycle, water-cooled, L head vertical type with bore of 3.75 inches and stroke of 4.5 inches, having an S. A. E. rating of 22.5 horsepower. The engine is built with extreme care and the cylinders are tested under hydraulic pressure to insure against leaks and other defects. The water spaces are large to afford a free circulation of water. The cylinders, piston, crankshaft, camshaft, wristpins, etc., are all ground to size. The valves are large and are at the left side, being completely enclosed. The crankcase is aluminum alloy and is of liberal proportions. The supporting arms are unusually large. The bearings are of generous size and the shafts are carefully heat treated. The lubrication is a combination force feed by a gear pump and splash, the bearings of the crankshaft and connecting rods being flooded and the drainage forming a constant level. The ignition is by a high-tension magneto with fixed spark, the acceleration being by varying the fuel supply.

The clutch is a multiple disc type operated in a bath of lubricant supplied from the motor that is extremely flexible and easy to control. The transmission gearset is a selective type with shafts and gears of 3.5 per cent. nickel steel, the gears being specially heat treated. The shafts are mounted on roller bearings. The arrangement gives three forward speeds and reverse. The motor, clutch and gearset are assembled as a unit with the emergency brake and gearset lever mounted on the cover of the gearset case. The drive is by shaft fitted with two universal joints to a jackshaft that is assembled with the rear axle. This jackshaft is contained in a steel housing fixed to the axle, and pinions at the ends of the shafts mesh with internal gears cut in the inner peripheries of the drums mounted on the rear wheels. The weight is carried by the solid axle. The jackshaft is divided by the differential gear and it is mounted on heavy roller bearings.

The frame is a carbon steel channel section 4.5 inches wide, 2.75 inches deep and .15625 inch thickness. The springs are semi-elliptic and of such length as will secure easy riding. The front axle is a steel drop forged I section, fitted with heat treated spindles of nickel steel and bearings of large size. The steering gear is an irreversible worm and nut type. The brakes are internal expanding in and external contracting on drums on the rear wheels 15 inches diameter and 2.5 inches face. The speed may be governed from 15 to 25 miles an hour maximum, the governor being sealed to insure this result. Care is taken to provide large grease cups and oilers for all wearing parts and the radiator is mounted on springs to eliminate strains from chassis distortion. The claim of high efficiency is made for this construction.



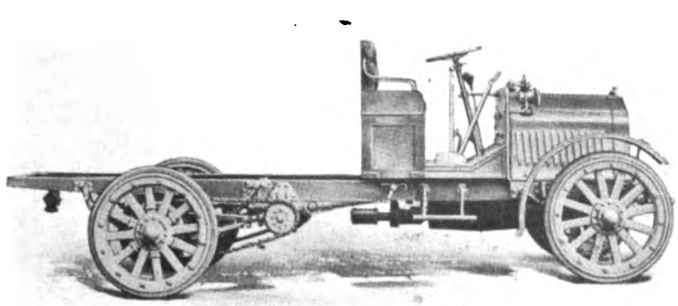
The Chase 500-Pound Delivery Wagon. The Stegeman Two-Ton Truck.

Selden Makes Initial Appearance.

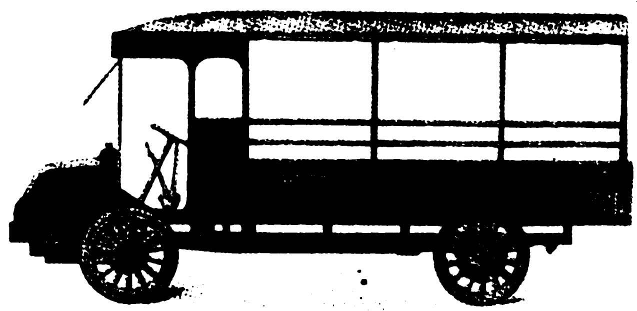
The new Selden 2000-pound delivery wagon, built by the Selden Truck Sales Company, Rochester, N. Y.,

was seen at Madison Square Garden. This machine has a unit power plant with a four-cylinder, water-cooled, L head motor, with the cylinders cast en bloc, and bore of 3.75 inches and stroke of 5.25 inches. The engine is cooled by a circulation of water by a centrifugal pump through a vertical tube radiator and a belt driven fan. The lubrication is by a plunger pump driven by an eccentric from the camshaft that floods the main bearings and timing gears and maintains a constant level in the crankcase base for splash. The carburetor is an automatic float feed type and the ignition is a dual system. The motor is controlled by a sealed governor.

The clutch is a multiple disc construction with six of the 13 plates faced with anti-friction material. The transmission gearset is a selective type with three forward speeds and reverse and the shafts and gears of heat treated nickel steel are mounted on taper roller bearings. There is a universal joint in the shaft between the gearset and the jackshaft. The jackshaft is a semi-floating construction mounted in spherical bearings with shafts 1.375 inches diameter, carried on roller bearings. The drive is by side chains. The frame is a steel channel 5.625 inches width and is suspended on semi-elliptic springs, 42 inches length and 2.25 inches width forward, and 48 inches length and 2.5 inches width rear. The front axle is an I section and the rear axle a drop forging, both heat treated. The wheels are 36 inches diameter, fitted with 3.5-inch solid tires forward and four-inch solid tires rear. The wheelbase is either 125 or 145 inches. The drive is left side with a steering gear of the worm and nut type, and the control levers are at the centre. The service brake operates within drums on the jackshaft and the emergency brake within 16-inch drums on the rear wheels. The maximum speed is 16 miles an hour.



The Selden One-Ton Delivery Wagon.



The Walter-Latil Front Wheel Drive Truck.

Bessemer Adds to Line.

The Bessemer Motor Truck Company, Grove City, Penn., which exhibited at Grand Central Palace, first built a ton wagon, and this year the line has been increased by the addition of models A and C, B being the original. Model C has a capacity of 1500 pounds and model A 3000 pounds, these being built to the initial design with parts proportionate to the capacities, though the 1500-pound machine differs in a number of essential details.

Taking the wagons in the order of their capacity: The motor of model C is a four-cylinder vertical water-cooled type with bore of 3.75 inches and stroke of 4.5 inches and is rated at 25 horsepower. The water is thermo-syphon circulated and the radiation is promoted by the use of a fan. The lubrication is a combination force feed and splash and the ignition is by a high-tension magneto with fixed spark. The clutch is a cone and the transmission gearset is a selective type with three forward speeds and reverse, with nickel steel gears, the shafts being mounted on roller bearings. The drive from the jackshaft is by side chains. The front axle is a rectangular drop forged steel section two by 1.625 inches, and the rear axle is a similar section 2.5 by 1.75 inches. The frame is a pressed steel channel section and the springs are semi-elliptic. The wheels are 34 inches and are shod with 2.5-inch tires forward and three-inch tires at the rear. The wheelbase is 108 inches.

Model B and model A have motors with bore of 3.75 inches and 5.25 inches stroke rated at 30 horsepower, the details of which are the same as with model C, but with these the gearset case is assembled as a unit with the jackshaft and the shafts are mounted on annular ball bearings. The same number of speed ratios is provided. The front and rear axles are Timken constructions and are fitted with Timken roller bearings. The wheels are 34 inches diameter and model B has three-inch tires forward and 3.5-inch tires at the rear, while model A has 3.5-inch tires forward and four-inch tires at the rear. The wheelbase of model B is 120 inches and of model A 136 inches. The brakes are internal expanding in and external contracting on drums on the rear wheels, the bands and shoes being faced with Raybestos. The diameter of the drums on models B and A is 14.75 inches with face three inches width. With model C the brake drums are 13.5 inches diameter and 2.75 inches width.

Decatur Shows Refinements.

The Decatur delivery wagon, shown at Grand Central Palace, built by the Grand Rapids Motor Truck Company, Grand Rapids, Mich., while it has not been materially changed in any detail, has been considerably refined with a view of increasing accessibility. For instance, the dust pan is now suspended by latches, spring retained, so that in a few seconds this may be removed for work or inspection. The seat

unit is similarly secured, and the rear springs instead of being of the platform type are semi-elliptic and are fitted with suspension members that slide on guides on the sides of the chassis frame with the deflection or reflexion, it being claimed that this is more satisfactory than when the customary swinging shackle is used. Extreme care has been taken to afford lubrication to ali moving parts, either by large grease cups or oilers.

Durable Dayton, Modern and Mais.

In the Durable Dayton machines, shown by the Dayton Auto-Truck Company, Dayton, O., at Grand Central Palace, a change has been made from Milwaukee to Wisconsin motors and the radius rods are of Timken construction. With the two-ton chassis the standard wheelbase is 120 inches, but an option is given of 150 inches.

Slight changes have been made in the Modern machines, shown at Grand Central Palace by the Bowling Green Motor Car Company, Bowling Green, O., in that springs have been placed beneath the clutch facings and a honeycomb type of radiator and a new form of radius rod are used. With all models the option of 120 or 136-inch wheelbase and the driver's seat over or behind the motor are given. Previously all seats were behind the motors.

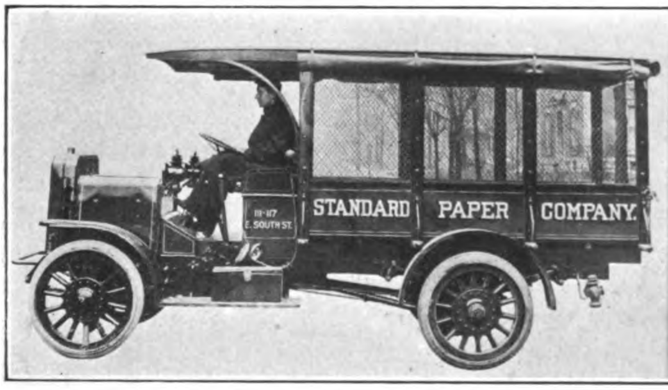
The Mais wagons and trucks, exhibited at Grand Central Palace by the Mais Motor Truck Company, Indianapolis, Ind., now have pressed steel frames instead of channel steel section, for the two, 2.5 and three-ton sizes, but no change has been made with the 1.5-ton chassis. The design has been perfected in that the radius rod ends are fixed in a heavy member that is swivelled to have movement in a block supported between two frame cross members, and this is in effect a universal joint on which the tractive effort is directed. This block is lubricated by copper tubes connected with large grease cups at either side of the chassis frame. In addition the rear and the wheel bearings have been increased, and the sizes of the front axles on the three larger chassis are greater.

Two Pope-Hartford Models.

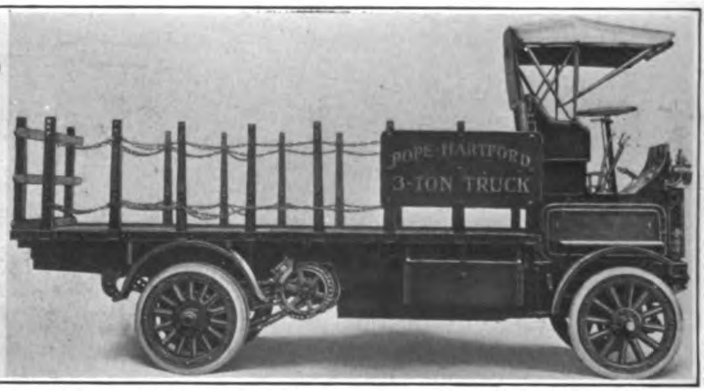
The Pope-Hartford trucks, built by the Pope Manufacturing Company, Hartford, Conn., were shown at Madison Square Garden in the three and five-ton models. The three-ton chassis has a longer wheelbase, a transmission gearset having four forward speeds and reverse, and the service brake on the jackshaft ends has contracting shoes of the locomotive type. The engine is somewhat larger. All of these features are reproduced in the five-ton chassis. The machines were described to considerable length in the preceding issue.

New KisselKar Delivery Wagon.

The feature of the display made by the Kissel Motor Car Company, Hartford, Wis., at Madison Square Garden, was the new 2500-pound delivery wagon, which is claimed by the maker to be the best constructed vehicle of the size ever placed in the market. The motor is the characteristic Kissel design with L head and the valves at the left side, four cylinders, water-cooled, with bore of 4.25 inches and stroke of 5.25 inches, and is rated at 36 horsepower. The motor is lubricated by splash from a constant level of lubricant maintained by an adjustable gear driven pump and by a flow of oil to the bearings and timing gears. The engine is cooled by a circulation of water by a centrifugal pump through a radiating system having a capacity of seven gallons. The radiator is a vertical tube type



The Mais Two-Ton Delivery Wagon.



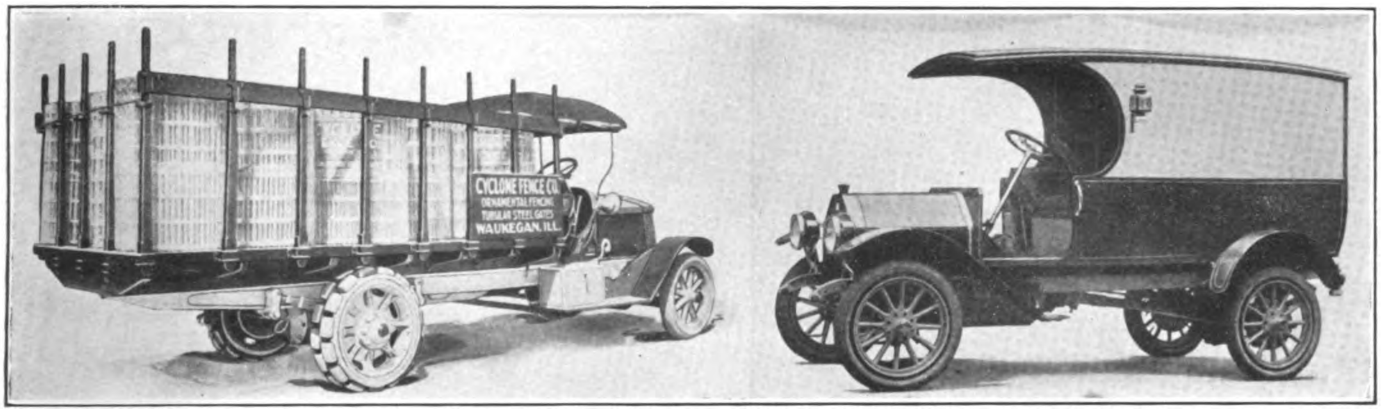
The Pope-Hartford Five-Ton Truck.

with spiral radiating fins and it is carried in a frame of cast aluminum with large radiating fins. The radiator is suspended on housed springs supported by the chassis frame. The ignition is by a Mea magneto which gives the same intensity of spark in any position of the control lever.

The clutch is a leather-faced cone. The motor, clutch and control lever quadrant are carried in a subframe that is mounted at three points, one forward and the others at either side of the chassis frame, on brackets through which vertical guides pass, and these brackets are supported by helical springs below them on the guides, while similar springs resist any upward movement of the brackets on the guides. That is, the sub-frame is protected against shock of any kind by the springs. The drive shaft between the clutch and the transmission gearset is fitted with two universal joints. The gearset and the differential are assembled as a unit and are suspended at a single point forward and at two points at the rear by frame cross members, and the jackshaft is further supported by heavy hangers carried on the frame. The gearset has four forward speeds and reverse, giving three, seven, 13, 16

and two miles an hour. The gearset shafts and gears are very large and the shafts are carried on annular ball bearings. Two inspection plates afford access to the gearset case for examination, and the entire cover may be removed for work. The differential is fitted with a lock that is operated by a foot lever conveniently located in the footboard. The drive is by side chain to the rear wheels.

The frame is a channel section five inches width and this is suspended on semi-elliptic springs, those at the rear being underslung. The length of the forward springs is 38 inches and of the rear springs 50 inches, both 2.5 inches width. The front axle is an I section of drop forged steel and the rear axle a rectangular drop forging. The wheels are mounted on roller bearings and are 34 inches diameter forward and 38 inches rear, with tires 3.5 inches forward and five inches rear. The brakes are internal expanding in and external contracting on drums on the rear wheels. The speed of the motor is governed by a Pierce controller that may be set at any desired point of regulation. The details of construction are well thought out, the provisions for lubrication being especially thorough. Even the starting crank is mounted on the sub-frame. The wheelbase of the chassis is 132 inches and the turning radius is but 25 feet.



The Smith Six-Ton Worm Driven Truck.

The Buick 1500-Pound Delivery Wagon.

Smith-Milwaukee Is Worm Driven.

The Smith-Milwaukee trucks, built by the A. O. Smith Company, Milwaukee, Wis., seen at Grand Central Palace, were shown for the first time in the East and attracted no end of attention, the six-ton chassis being the largest worm driven machine built in this country. The smaller chassis is now rated at 3.5 tons instead of three. The feature of this construction is the combination of the transmission gearset, the driving shaft and the rear axle as a unit, the large torque tube being enlarged at the forward end and joined with the gearset case, and the tractive effort being exerted through this torque tube against the heavy frame cross member that supports the forward end of the transmission case. The relation of the torque tube is preserved by large radius rods that extend to it from the ends of the rear axle housing. The individual clutch type selective gearset is unusually heavy and has constantly meshed herringbone gears. The shafts are each mounted in three large bearings and the entire mechanism is suspended from the cover of the case, so that it may be removed by taking out the cover retaining bolts.

With the increase of capacity of the smaller truck the Continental motor has been changed from a 4.5-inch bore and 5.5-inch stroke, to a five-inch bore and 5.75-inch stroke. With the six-ton chassis, which has a motor with bore of 5.25 inches and stroke of 5.75 inches, the brake linkage has been changed and the better compounded, steel tubing is used instead of rods, and the radius rods are pressed steel tubing of larger diameter. With both chassis a pressed steel housing is used for the rear axle instead of a casting, this affording greater strength and lighter construction. These chassis are noticeable for the steel cored wheels, with the brake drums cast integral, the spokes being semi-circular in section, united by heavy webs. Another feature is the skeleton radiator frame, which is designed to increase radiation.

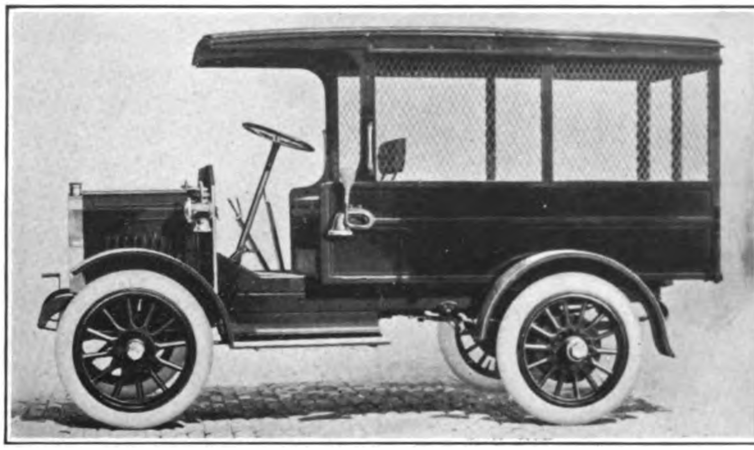
The Standard Motor Truck Company, Detroit, Mich., exhibited its new three-ton machines at Grand Central Palace. These were described in the preceding issue of MOTOR TRUCK.

New Buick Delivery Wagon.

The new Buick delivery wagon chassis was shown for the first time at Madison Square Garden, and this is built in two sizes, having capacities of 1000 and 1500 pounds. The principal difference is in wheelbase, which is respectively 100 and 120 inches, the larger being fitted with 34 by five-inch pneumatic tires instead of 34 by 4.5-inch shoes. The machine is well designed and is carefully built, being intended for fast, light delivery. The motor is a four-cylinder, four-cycle, water-cooled, L head type with the cylinders cast en bloc and the water spaces are very large to insure efficient cooling by thermo-syphon circulation. The diameter of the connections between the motor and the vertical tube radiator is 2.25 inches. Radiation is promoted by a fan driven by a flat belt. The bore of the cylinder is three inches and the stroke five inches, this giving a horsepower rating by S. A. E. formula of 14.4, but with a bore to stroke ratio of 1:1.66 it is claimed that the power actually delivered is approximately double the rating. The motor is fitted with a single detachable

head and the intake manifold passes through the water jacket, thus heating the fuel before it is delivered to the cylinders. The crankshaft is carried on three bearings and is unusually heavy. The valves are enclosed and protected from dust. The motor is lubricated by oil circulated by a gear driven pump that insures a constant level for splash lubrication of all parts, the lubricant passing through a sight feed on the dash. The oil is filtered before passing through the pump. The ignition is by a magneto with a reserve of dry cells. The motor is governed to any maximum speed by a governor that is said to be unusually efficient. The governor is operated by the magneto shaft and is of the centrifugal type. It is located at the right side of the motor. The carburetor is at the left side and the mixture is carried through a cored passage between the cylinders to the right side of the motor and thence through the intake manifold to the cylinders. Governor throttle is at branch of manifold.

The clutch is a leather faced cone and the gearset of the transmission is a selective sliding gear type, giving three forward speeds and reverse, and the drive is by shaft to a rear axle of the three-quarters floating type with the driving shafts mounted on nickel steel Hyatt roller bearings. The driving shaft is enclosed in a large torque tube, the forward end of which is supported by a large yoke coupled to the centre cross member of the frame. Stout radius rods from the rear axle to the yoke maintain the relation of the rear axle. The frame is a pressed steel channel section of large size and it is strongly reinforced. The front springs are semi-elliptic and the rear full elliptic. One feature of the construction is that the power plant, suspended at three points, may be easily removed, and the driving shaft, torque tube and rear axle may be removed as another unit. The front axle is a heavy I section. The control of the gearset and the emergency brake are at the centre and the drive is by a wheel at the left side. The service brake is external contracting on and the emergency brake internal expanding in drums bolted to the rear wheels.



The Flint Light Delivery Wagon.

The Brown Commercial Car.

Flint Is Entirely New.

The Flint delivery wagon, built by the Flint Motor Wagon Department of the Durant-Dort Carriage Company, Flint, Mich., was seen at Grand Central Palace. This is an entirely new construction and while the motor is in front of the driver and the wheelbase is 106 inches, it is maintained that it is but half the length of an animal equipment. The capacity is 1600 pounds. The motor is a four-cylinder, water-cooled, L head type, with bore of 3.75 inches and stroke of 4.5 inches, having a S. A. E. rating of 22.5 horsepower.

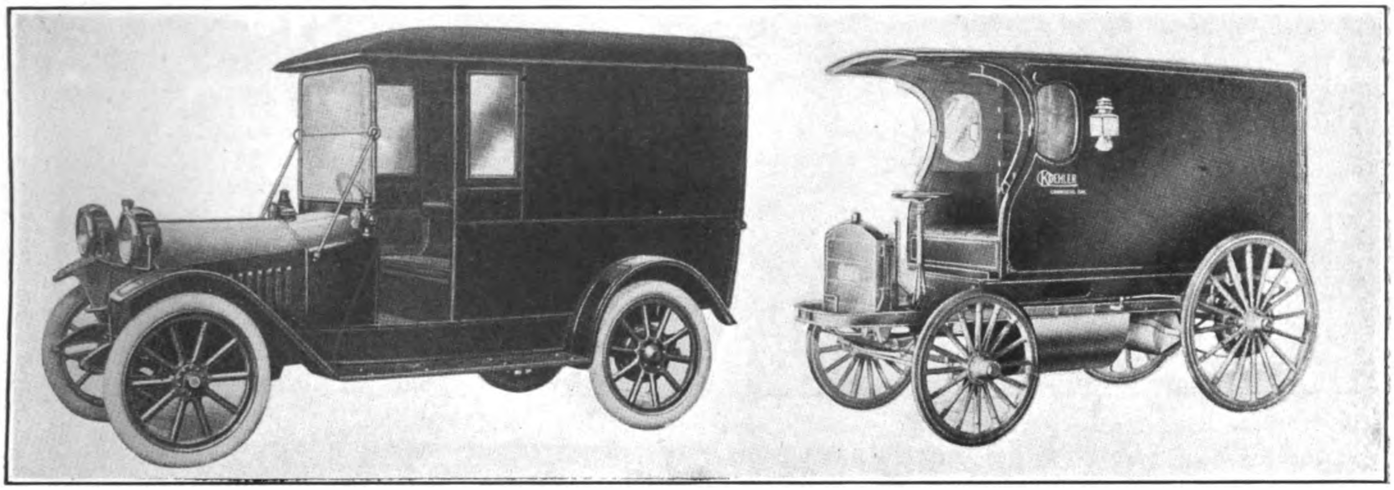
The cylinders are cast en bloc. The construction is in every way conventional. The cooling is by a water circulation by a centrifugal pump through a vertical flat tube radiator and by a 16-inch fan driven by a flat belt. The lubrication is by splash in a constant level pool in the crankcase maintained by a gear driven pump. The ignition is by a dual system with Remy magneto and storage battery. The motor is governed by a ball governor set for a maximum of 18 miles an hour.

The clutch is a leather-faced cone, 14.25 inches diameter and three inches face, with two universal joints between the motor and the transmission gearset. The gearset is a selective type having three forward speeds and reverse and all the gears have inch faces. The shafts are carried on roller bearings. The drive is by a shaft 1.25 inches diameter with two universal joints between the gearset and the differential. The power plant, clutch and gearset are carried in a sub-frame that is supported at two points from the forward cross frame member, and the rear end is suspended from a yoke carried on a bracket on the centre cross frame member.

The frame back of the centre is strongly braced with gussets and diagonals from the side to the centre and rear members. The rear axle is a full floating construction and just inside the spring seats the ends of the torque rods are fixed on pivots that permit a side or transverse movement. The forward ends of the rods are secured to a curved member that has a small yoke that is connected with a member so designed as to pivot transversely in a bracket fixed to the centre cross member of the frame. The forward end construction is in reality a gimbal that will compensate for any chassis distortion, and as the forward yoke

connection of the rods will turn in the curved member, the design is termed a triple-acting joint connection by the builder. The pinion gears and shafts of the rear axle are 3.5 per cent. nickel steel. The differential bearings are Hyatt roller and New Departure for the shafts and hubs. The forward axle is an I section 1.75 by 2.625 inches of drop forged steel. The springs are semi-elliptic, 40 by 2.25 inches forward and 48 by 2.25 inches rear, with all shackle bolts hardened and ground and fitted with grease cups. The frame is a channel section of large size. The steering wheel is at the left side and the gear is an irreversible screw and nut type. The hand levers are at the centre and the spark and throttle levers are mounted above the steering wheel. The service brake is external contracting on a 10-inch drum on the shaft directly back of the gearset case, the band being 2.25 inches width. The emergency brake has shoes two inches width operating within 16-inch drums bolted to the rear wheels. The wheels are 34 inches diameter and are shod with three-inch solid tires forward and 3.5-inch solid tires and four inches length. The bearings are bushed with Parsons' white bronze.

The connecting rods are steel drop forgings, heat treated, with bearings 2.5 inches length, and the wristpin diameter is an inch. The big end bearings are Parsons' white bronze and the small ends are bronze bushed. The motor is lubricated by oil circulated by two plunger pumps driven by eccentrics on the camshaft, and it is carried by a system of tubing to the main bearings and the timing gears, and drains into the crankcase, where a constant level is maintained for splash lubrication of the camshaft bearings, cams, valve tappets, connecting rods, pistons and cylinders. The oil is filtered and there is provision for cleaning the filter. The motor is cooled by a circulation of water forced through a vertical radiator by a centrifugal pump and a fan driven by a flat belt. The radiator is suspended on coiled springs and is insured against stresses of any kind from chassis distortion. The carburetor is an automatic float feed type. The ignition is supplied by a magneto of Remy manufacture.



The Hupmobile 1000-Pound Delivery Wagon.

The Koehler 1600-Pound Delivery Wagon.

rear, or 4.5-inch pneumatic tires forward and five-inch pneumatic tires rear.

Brown Uses Internal Gear.

The Brown commercial wagon, built by the Brown Commercial Car Company, Peru, Ind., was shown for the first time at Grand Central Palace. This is designed for fast, light delivery, having capacity of 1500 pounds, and the principal feature is the use of the internal or concentric gear drive. This machine has a unit power plant with a four-cylinder, four-cycle, L head, water-cooled, vertical motor, with the cylinders cast en bloc, with bore of 3.75 inches and stroke of 5.25 inches, having an S. A. E. rating of 22.5 horsepower. The crankcase is of aluminum and the lower section may be removed without changing the crankshaft bearings. The water spaces are liberal to insure efficient cooling and the cylinders are carefully finished. The pistons are a special gray iron and are accurately ground, being fitted with four eccentric compression rings. The crankshaft is a high grade steel drop forging, heat treated, 1.75 inches diameter, with front, centre and rear bearings respectively 2.75, three

The clutch is a dry plate design, with 27 plates, 14 of which are faced on either side with an anti-friction material. The transmission gearset is a selective type giving three forward speeds and reverse, the shafts being mounted on annular ball bearings, and the gears being of heat treated nickel steel. The drive is through a 1.75-inch tubular shaft fitted at either end with dust proof universal joints, and the torque and driving strains are taken by two large tubes extending from the brake spiders to a cross member in the centre of the chassis. The forward ends of the tubes are mounted with a globe that is carried in a socket bushed with bronze, contained in a bracket on the cross member. The shaft extends through an opening in the heavy drop forged rear axle web to a countershaft bolted at the rear of the axle, and a pinion meshes with the bevel gear of the differential. Pinions at the outer ends of the shafts mesh with the internal gears bolted to the rear wheels. The wheels are carried on two rows of annular ball bearings. The driving gears are enclosed and are protected against dust and abrasion. The front axle is a drop forged steel I section with spindles

of nickel steel with annular ball bearings. The frame is of pressed steel channel with width of 4.5 inches and depth of four inches at the centre, and the springs are semi-elliptic, 40 inches length forward and 50 inches length rear, two inches width. The control is to a steering wheel at the left side with gearset and emergency brake levers in the centre, and pedals for the clutch and service brake.

Hupmobile Delivery Model.

The Hupmobile delivery wagon chassis, shown at Madison Square Garden by the Hupp Motor Car Company, Detroit, Mich., does not differ from the regular Hupmobile touring car chassis design, but it has auxiliary helical springs fitted at the rear which take a part of the load when the springs are compressed by a load, and the motor is fitted with the Pierce speed controller, by which an automatic throttle in the inlet manifold is operated by a centrifugal governor driven by flexible shaft from the left front wheel. When a predetermined speed of the machine has been reached the controller becomes operative, and below that speed control is by accelerator operated by foot, permitting use of full power of motor on low or second speed.

Koehler Commercial Car.

The Koehler commercial car, built for the H. J. Koehler Sporting Goods Company, New York City, which was new last year, was shown at Grand Central Palace, and it had been somewhat improved, one refinement being the betterment of the high speed clutch mechanism of the planetary transmission. Another is the adoption of an internal expanding brake, the shoes of which are operated within the drums that carry the sprockets on the rear wheels by cams, and which afford a very large area of braking surface. The rear sprockets are integral with the brake drums and the construction gives an efficient brake that is easily adjustable as well as extremely efficient and practical.

Sullivan Delivery Wagons.

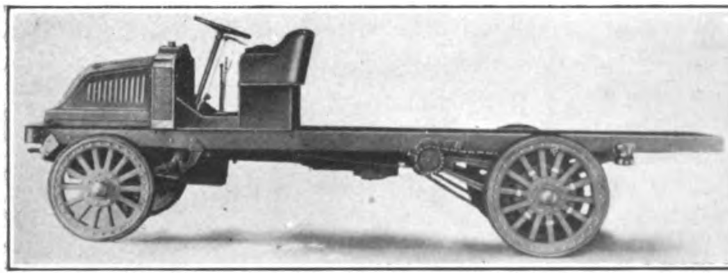
Several minor changes have been made in the Sullivan delivery wagons built by the Sullivan Motor Car Company, Rochester, N. Y., shown at Grand Central Palace and these include the incorporation of the transmission with the jackshaft, the use of two universal joints in the driving shaft, the use of service brakes on the jackshafts, and a heavier front axle with the 1500-2000 pound chassis, and the fitting of three-inch tires instead of 2.5-inch shoes on the rear wheels. The smaller chassis has not been changed in design from previous productions.

Maccarr Is a New Product.

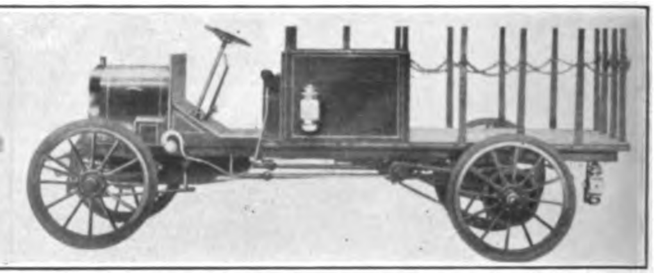
The Maccarr delivery wagon, built by the Maccarr Company, Allentown, Penn., was shown for the first time at Grand Central Palace. It is the product of a concern of which J. M. Mack is designer and executive, he having been for years identified with the Mack Bros. Motor Car Company and later with the International Motors Company. The machines are built in two sizes, 1500 and 2000 pounds. The smaller machine is equipped with a unit power plant with cylinders having a bore of 3.75 inches and stroke of 5.5 inches, with a claimed S. A. E. rating of 28 horsepower. The cylinders are cast en bloc. The engine is water-cooled and is lubricated by splash in a constant level of oil maintained by a pump and by direct circulation to the main and connecting rod bearings. The cooling is by a circulation of water through a tubular radiator by a gear driven pump and a fan mounted on a bracket carrying a ball bearing and driven by a flat belt. The ignition is by a Bosch dual system. The carburetor is an automatic float feed type. The motor is governed to any speed between 500 and 1000 revolutions by a sealed governor.

The clutch is a multiple dry disc construction that is easily removable. The drive is through a selective type sliding gearset giving three forward speeds and reverse and a shaft having two universal joints to the Timken full floating rear axle, the shafts being of special alloy steel and having Timken roller bearings. The front axle is a drop forged steel I section of special construction. The frame is a steel channel section carried on semi-elliptic springs forward, 38 inches length and two inches width, and a platform at the rear with side members 48 inches length and two inches width, with a cross member 39 inches length and two inches width. The wheels are 36 inches diameter with 4.5-inch pneumatic tires. The steering gear is an irreversible worm and sector type and the brakes are internal expanding in and external contracting on drums 17 inches diameter and 2.5 inches width on the rear wheels, both sets being equalized. The drive is left side with the control levers at the centre and spark and throttle levers on the steering column. The wheelbase is 114 or 126 inches.

The larger chassis differs from the smaller in that it had wheelbase of 126 or 138 inches, the drive is by shaft, countershaft and side chains, the springs are 2.5 inches width, the front axle is a heavier drop forged I section and the rear axle is hammer forged from nickel steel with the spring seats forged integral, the service



The Kelly Model K-40 Three-Ton Truck.



The Sullivan 1500-2000 Pound Delivery Wagon.

brake is internal expanding in drums on the counter-shaft and the emergency brake is internal expanding in drums on the rear wheels, and the 36-inch wheels are shod with three-inch solid tires forward and four-inch solid tires at the rear.

Croce Makes First Appearance.

The Croce wagons and trucks, built by the Croce Auto Company, Asbury Park, N. J., were shown for the first time at any exhibition, although the company has been producing them for a number of years. These machines are constructed of standard components, having Wisconsin motors, Brown-Lipe transmission gearsets, Spicer universal joints in the transmission shafts, Timken axles, Bosch magnetos and Schebler carburetors, and a number of exclusive features covered by Croce patents. The sizes built are 1500, 3000, 4000, 6000 and 10,000 pounds, but limited space prevented the display of the 3000 and 10,000-pound machines.

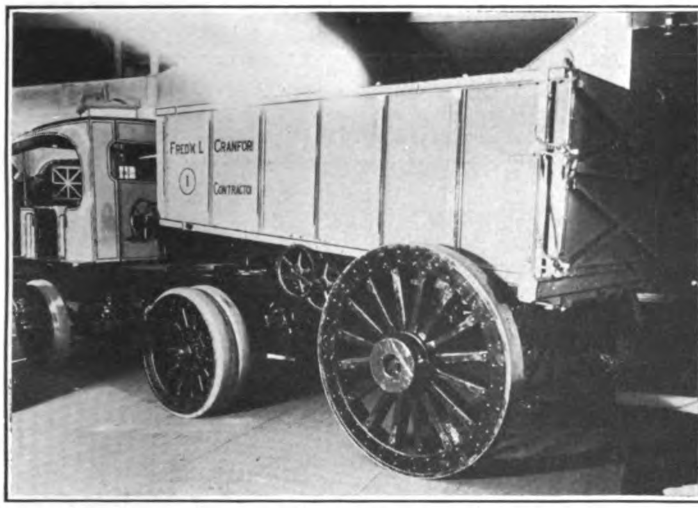
The 1500-pound chassis has a motor with bore of 3.75 inches and stroke of five inches, with the cylinders cast en bloc, and the others are with T head engines with the cylinders cast in pairs, with bore of 4.25 inches and stroke of five inches for the 3000 and 4000-pound chassis, and with bore of 4.75 inches and stroke of 5.5 inches for the 6000 and 10,000-pound chassis. The main difference in these machines aside from the engines is in size of parts, all having the Croce clutch, in which made integral with the cone is a sleeve on which are two collars. The clutch shaft extends through this sleeve, the sleeve enclosing the clutch spring, the thrust bearing and a universal joint, and the roller bearing of the clutch acts as a brake and minimizes the spinning of the clutch. On the 1500-pound chassis the withdrawal of the clutch engages a cone brake on the shaft with a member included in the universal joint mounted on the front side of the transmission gearset case, and as this cone is faced with asbestos its operation is noiseless and the wear negligible.

The Croce radiator has a base of cast brass and the construction is the tube principle used for steam boilers. The tubes are horizontal and are expanded and are soldered. The tubes may be easily repaired in the event of leak, but a temporary repair may be made by plugging the open ends of the defective tube with corks, and the machine may be used without reduced efficiency. Another device is the bumper, which is built with heavy rods carried on the spring horns on which are mounted the bumper guides. There is a longitudinal movement permitted, heavy helical springs maintaining the bumper at the greatest distance from the frame. As the springs are compressed the bumper is moved on the rods, the shock being compensated proportionate to the strength of the spring. The wheelbase of each model in order of size is 100, 120, 144, 156 and 192 inches.

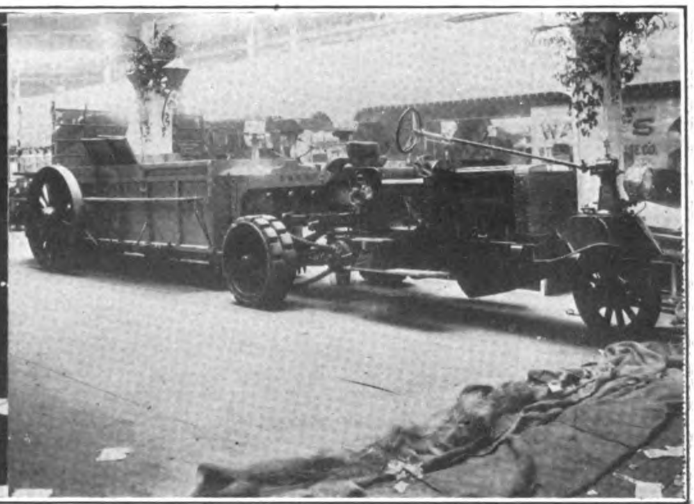
Increase in Dart Line.

The Dart Motor Manufacturing Company, Waterloo, Ia., which last year built a single chassis, this being equipped with a double-opposed motor, showed at Grand Central Palace model B, of 2000 pounds capacity, and model C, of 3000 pounds capacity. The construction is similar throughout, although the machines differ somewhat in detail. The model B has a wheelbase of 114 inches and the motor is a four-cylinder, water-cooled, L head type with the cylinders cast en bloc, the bore being 4.0625 and the stroke 4.5 inches, with a rating of 25-30 horsepower. The motor is cooled by a circulation through a honeycomb radiator by a centrifugal pump. The radiator is mounted by ball and socket trunnions on the frame. The lubrication is a constant level system fed by a gear driven pump, and the ignition is by a Bosch magneto with a fixed spark. The carburetor is an automatic float feed type.

The clutch is a cone, leather faced, with springs beneath the facing to insure ease of engagement, and the drive is through a gearset of a selective type assembled with the jackshaft, having three forward speeds and reverse, the gears having .75-inch faces and the gears and shafts being of nickel steel and heat treated. The jackshaft is a three-quarters floating construction, with shafts of heat treated nickel steel 1.5

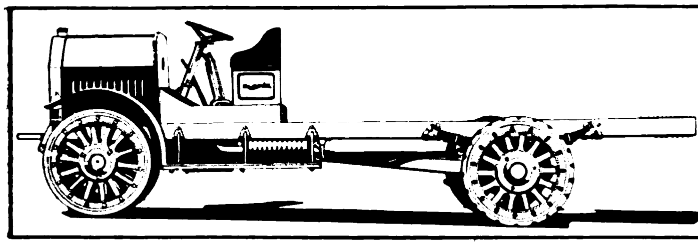


The Garford Truck with 12-Ton Body.

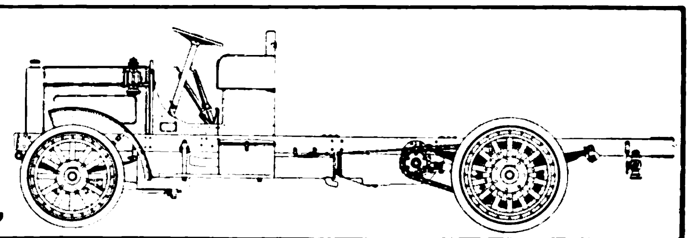

The Martin Tractor and Street Cleaning Body.

inches diameter, mounted on roller and annular ball bearings. The front axle is a drop forged I section with nickel steel steering knuckle spindles, and the rear axle is a drop forged rectangular steel section. The frame is pressed steel channel of liberal proportions and is mounted on semi-elliptic springs, the forward set being 37 inches length and two inches width, and the rear set 46 inches length and 2.25 inches width, of electro silica-manganese steel. The drive is at the left side and the control levers are in the centre. The steering gear is a screw and nut irreversible type. The service brake has contracting shoes 2.5 inches width acting on a drum 14 inches diameter, and the emergency brake has expanding shoes three inches width operating within the same drum, which are bolted to the rear wheels. The 36-inch wheels are shod with 2.5-inch solid tires forward and three-inch tires at the rear.

The model C chassis has a four-cylinder L head motor with bore of 4.25 inches and stroke of five inches, rated at 35-40 horsepower, with the cylinders cast in pairs. The motor is cooled by water circulated by a centrifugal pump. The honeycomb radiator is similarly mounted. The ignition is by an Eisemann magneto with automatic spark advance. The clutch is a cone type and the transmission gearset is the same with .825-inch face gears. The jackshaft is the same. The frame is similar material as model B and the springs are 40 inches length and 2.5 inches width and 48 inches length and 2.5 inches width for the front and rear respectively. The axles are the same construction and the wheels are 34 inches forward, 38 inches rear, shod with 3.5-inch tires. The drive is left side with the control levers at the centre. The machine has the special Dart foot control, by which the accelerator may be set at any desired position, but this may be instantly changed or released.



The Studebaker Three-Ton Truck.



The Peerless 1913 Chassis.

Mais Designed Studebaker.

The Studebaker Corporation, Detroit, Mich., showed at Grand Central Palace a three-ton vehicle designed by A. F. Mais, which has innumerable features. While it is driven by concentric gears and so constructed as to afford a straight line drive when loaded, these are by no means all of its features. The machine is practically built in four units, all of which may be removed as assemblies, and the purpose has been to obtain a degree of flexibility that will insure against stresses from distortion. The power plant is a unit and with it is mounted the steering column and the clutch and service brake pedal shafts, as well as the sight feed gauge for the lubrication system. Rings are placed in the motor arms and back of the gearset case so that the assembly may be hoisted out after loosening five bolts. The steering gear can be removed by taking out two bolts, and the control can be taken out with the removal of four bolts.

The motor is a T head type with cylinders cast in pairs with bore of 4.375 inches and stroke of 6.5, this giving a bore to stroke ratio of 1:1.495. The crankcase is a solid casting. The crankshaft is carried on three large annular ball bearings and all the cam and gear shafts have similar bearings. The lubrication is an automatic force feed that sprays the bearings and timing gears. The cooling is by water circulated by a centrifugal pump through a radiator and by an 18-inch fan that draws a current of air through the radiator and a diaphragm directly on to the motor. The ignition is an Eisemann magneto with automatic spark control. The motor is regulated by a governor driven off the transmission gearset countershaft.

The clutch is an expanding type with six shoes of cast aluminum alloy that have wedge-shaped tongues engaging with similar grooves in the inner periphery of the flywheel rim. The shoes are kept in engagement by helical springs that are compressed to engage or disengage them by radially acting arms that are connected with the clutch pedal. These shoes are operated in oil. The design is maintained to give increased area of surface contact, and while the shoes cannot slip the smooth surface prevents harsh engagement. The transmission gearset is a selective sliding gear type with four speeds forward and reverse, but no direct drive, the fourth ratio being in excess of the engine shaft movement. The drive is by shaft to a jackshaft or countershaft with a torpedo-shaped housing mounted forward of the rear axle. The driving shafts carry pinions at the outer ends that mesh with internal gears in drums on the rear wheels. The long radius rods extend from the axle forward to the centre cross member of the frame, on which they swing with the vertical movement of the rear axle. Ahead of the countershaft housing is a bracket and two large drums mounted on the driving shaft. On these drums the service and the first emergency brake bands constrict. The service brake is the band nearest the housing and the first emergency brake is the second, both being of a size. The second emergency brake, which is operated by a lever at the left of the driver, actuates long shoes in which are V shaped grooves which engage with V shaped collars integral with the internal gear drums. Because of the form the brake is self-adjusting so far as contact is concerned, and the brak-

ing area is very large. All the brakes are equalized.

The frame is a steel channel section six inches width and three inches depth and is carried on long semi-elliptic springs that have a very flat arc, permitting low suspension. The front axle is a reverse Le Moine type, I section, drop forged from chrome nickel steel and the rear axle is an I section of the same metal. These have annular ball bearings and are fitted with wheels 38 inches diameter, having five-inch single tires forward and five-inch dual tires rear. The drive is right side and the control levers are at the centre. The chassis is built in two sizes, with wheelbase of 144 and 180 inches. Other sizes of the same design are to be built by this company.

Little Change in Peerless.

But little change has been made in the Peerless trucks, built by the Peerless Motor Car Company, Cleveland, O., and shown at Madison Square Garden, the improvement being in the operating of the emergency brake, which has been changed so that the equalizing drawbar is carried in guides below the chassis frame, instead of using a shaft that projected through the frame members at either side. This eliminates the possibility of weakness developing at the shaft openings.

New Five-Ton Packard.

The new five-ton truck built by the Packard Motor Car Company, Detroit, Mich., was exhibited at Madison Square Garden. In general appearance it is an enlarged three-ton design, but it has some features of construction that are new, and some of these have been incorporated with the three-ton machine, which differs from the smaller two-ton chassis. The Packard design was identical for the two and three-ton chassis until the production of the largest size. The two-ton chassis has not been changed.

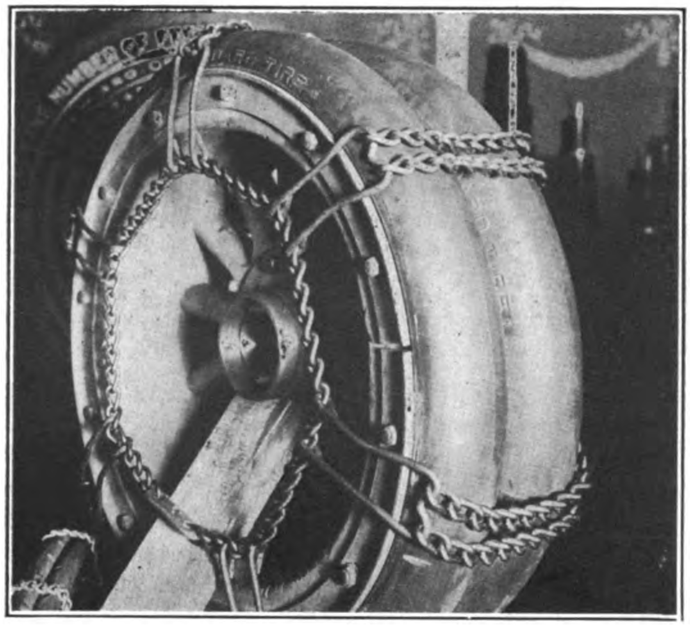
The three-ton chassis is now fitted with the new jackshaft hanger designed to carry the large contracting brake shoes of the locomotive type that act on drums carried on the jackshaft outboard ends. This construction gives metal-to-metal friction surfaces, large braking surface area, and makes possible adjustment that insures equalized braking effect. This same type of brake is used on the five-ton machine. The rear axle is a very heavy I section and on this the heavy semi-elliptic springs are seated. The spring saddle is shaped with side members that extend nearly the full depth of the spring and the ends of the saddles are transversely grooved. The spring clips are seated in these grooves and the ends extend through the upper flange of the axle and are secured by nuts. The form of the saddle clamps the springs and prevents movement of the leaves. The ends of the springs are mounted in members bolted under the side members of the frame in which they move with the deflection or reflexion. This design eliminates the usual wear of spring shackles and bolts.

B. A. Gramm's Trucks.

B. A. Gramm's trucks, built by the Gramm-Bernstein Company, Lima, O., were seen at Grand Central Palace. These were exhibited for the first time and were noticeable for the suspension of the motor on a sub-frame supported by lugs mounted between helical springs, for the transmission gearset giving four forward speeds and reverse, and the electric lighting and starting system. These machines, of two and 3.5 tons capacity, were described at length in the January issue.

Changes in Sternberg Line.

Several changes have been made in the motors and transmission gearsets of the Sternberg trucks, built by the Sternberg Manufacturing Company, Milwaukee, Wis., which were exhibited at Grand Central Palace. In the motors the stroke has been lengthened, the bore being 4.25 and the stroke 6.75 for the two and three-ton chassis, and 4.5 inches bore and 6.75 inches stroke for the four, five and six-ton chassis. The drop forged timing gears have been made larger and with wider faces, the wristpins are 1.25 inches diameter and



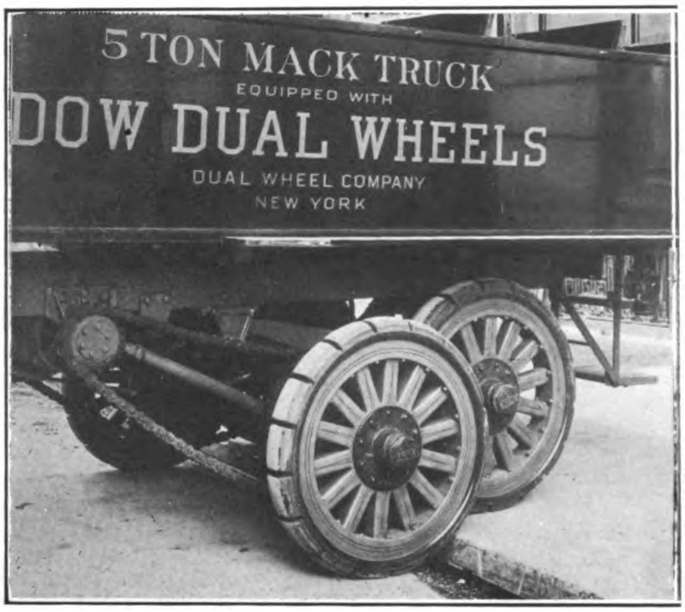
The New Truck Equipment Made by the Weed Chain Tire Grip Company.

made of nickel steel, the wristpin bearings in the pistons bushed with bronze, the camshafts have been increased in size and are made of heat treated nickel steel, the camshaft bearings increased in size, the pushrods increased in diameter and fitted to cast iron bushings, the valve mechanism enclosed, the valve caps made of tempered steel, the oil reservoirs and the size of the inspection plates increased, and a new governor adopted. In the gearset the shafts have been shortened, the pitch line of the gears changed and the number of dogs increased, a spline shaft is used instead of a square shaft, and the shafts are mounted on double row annular ball bearings instead of single row.

New Willys Utility Truck.

The Willys utility truck was included in the exhibit of the Gramm Motor Truck Company, Lima, O., at Madison Square Garden. This machine is rated at 1500 pounds capacity and it has a four-cylinder, water-cooled motor, with bore of four inches and stroke

of 4.5 inches, rated at 30 horsepower. The cylinders are cast singly. It has a five-bearing crankshaft and is cooled by thermo-syphon circulation through a radiator and a belt driven fan. The motor is lubricated by a constant level of oil maintained by a pump that floods the main bearings and the timing gears. The ignition is by a Remy magneto and battery. The clutch is a leather faced cone and the selective type transmission gearset gives three forward speeds and reverse. The gearset is assembled with the jackshaft. The drive is by side chains. The frame is a pressed steel channel section and is suspended on semi-elliptic springs 45 inches length and 2.25 inches width forward and 50 inches length and 2.5 inches width rear. The front axle is an I section and the rear axle is rectangular, both drop forgings. They are fitted with Timken bearings. The wheels are 36 inches diameter and are equipped with 3.5-inch tires at front and rear. The drive is at the right side and the steering gear is an irreversible worm and worm gear type. The control



The Dow Dual Wheel Equipment Installed on a Five-Ton Mack Truck.

levers are at the centre. The service brake is external contracting on the jackshaft and the emergency brake is internal expanding in drums on the rear wheels. The wheelbase is 120 inches and the tread 60 inches. The motor is regulated by a governor to a speed of 18 miles an hour.

LaFrance Gasoline-Hydraulic.

The LaFrance gasoline-hydraulic trucks were exhibited at Grand Central Palace by the Hydraulic Truck Sales Company, New York City, for the first time at any exhibition, but these machines are well known because in them is used the Manly hydraulic drive, in which a volume of oil is circulated through two motors by a pump actuated by a 48 horsepower gasoline motor, and from these motors the drive is by chains to sprockets on the rear wheels.

Sanford Shows New Model.

The Sanford Motor Truck Company, Syracuse, N. Y., exhibited at Grand Central Palace a new 3000-pound delivery wagon known as model L, which follows in every way the design of model K, the 2000-pound wagon, save that the wheelbase is 118 inches, the frame is a five-inch channel section and the springs, axles, tires and wheels are larger. The features of these machines are the unit power plants, the oiling system and governor of the motor, the Sanford clutch release, the transmission gearset and the provision for lubricating all moving parts.

Waverley Increases Rated Capacity.

The Waverley Company, Indianapolis, Ind., at Grand Central Palace, exhibited its 1000-pound delivery wagon, which is precisely the same design as the 600-pound wagon of 1912, with the components proportioned to give the required capacity and endurance. In this machine the motor is suspended transversely in the chassis and the drive is by silent chain to a countershaft and through this by herringbone gears to the gear incorporated with the differential in rear axle.

Dow Dual Wheel.

Incidental to the showing of vehicles inside was the exhibition of the Dow dual wheel equipment, which was used to drive a five-ton truck chassis fitted with a passenger body between the exhibition buildings. It is the invention of Alexander Dow and is an adaption of the bogey truck principle. The regular vehicle axle has mounted on the spindles what is known as an equalizing bar, and in the Dow construction this bar is so shaped that at either end of the bar is fitted an axle spindle on which is mounted a wheel in the regular manner, but the wheels overlap, the forward wheel being sufficiently outside of the rear wheel to insure good clearance. Both wheels are driven from a jackshaft sprocket and a brake operates on each wheel. The design gives four points of support to the rear axle instead of two, and the change of any one of these greatly reduces the movement of the axle and the consequent spring action is minimized. It is also claimed for the Dow dual wheel system that skidding is practically eliminated and the wear of tires much reduced. The tread of the vehicles is increased but an inch or two and the overlap of the wheels gives a distance of perhaps 21 inches with 36-inch wheels between the two lines of support. It is maintained that this construction can be adapted to forward wheels should this be desired.

Another interesting exhibit was the new truck tire chain displayed by the Weed Chain Tire Grip Company, which is practically explained by the accompanying illustration.

The Electric Storage Battery Company, Philadelphia, Penn., is distributing a series of four interesting booklets recently issued, which are devoted to Exide batteries and their use, both for electric vehicles and for gasoline machines, for engine starting, ignition and lighting. Two of the publications contain letters which reflect the experience of users of Exide batteries in vehicles, and in all conditions of service. These booklets are sent free at request.

BIG PROSPECTS FOR CHICAGO TRUCK SHOW.

THE second section, or part II of the Chicago motor vehicle show, devoted to service wagons, which will be opened Feb. 10 and continue until the evening of Feb. 15, will be, in point of space occupied, larger than any similar exhibition ever held in the Windy City, and if the expectations of Manager S. A. Miles are realized the exposition will have a few more makes of vehicles than were displayed in the metropolitan show. The exhibition this year will take place in the Coliseum and Annex, the First Regiment armory and the Wilson building, the last mentioned structure being an overflow in which will be seen four exhibits. There has been keen anticipation by the industry as to the results from the Chicago show from the viewpoint of business transacted and relations established, for it is maintained that with the experience at New York there is every reason to believe that there will be quite as many desirous of engaging in the sale of service wagons at Chicago, and if this belief is well founded the representatives of the manufacturers will be very largely increased.

The possibilities are, no doubt, very large, but it is impossible to determine the development of new business, as measured by added representation, until the production of the industry can be estimated, and there are many who are willing to act conservatively, after making contract for the sale of their output, rather than to plan expansion on the basis of contracts made but not delivered. But there is reason to believe there will be at least as large, and perhaps larger, number visiting the show with a view of making agencies and who will be willing to make good sized orders if deliveries can be made within a reasonable length of time.

Probably one of the problems that is now confronting the manufacturers is that of filling the orders contracted for within the times fixed, and yet take care of the business that is promised. At New York some of the makers maintained that they would not then be able to produce more than 50 per cent. of the vehicles that they might sell if they had the production capacity, and as more than 75 per cent. of those that made display at New York will exhibit at Chicago, additional orders would mean refusal or a readjustment of factory facilities that will meet the demand.

According to the latest list of vehicle exhibitors, and which may be considered substantially correct, there will be in all 72 different firms represented at Chicago, but as two of these will show both electric and gasoline machines there may be said to be 74. This number is eight more than exhibited at New York, and of the Chicago exhibitors there will be 22 makers who did not show at the metropolis, although several of them engaged space and then decided to withdraw.

If the western national show is to be judged by number of exhibitors then it has the largest exhibition of the year, with a probability of being closely pushed by the Boston exposition. But whether or not there will be more machines shown cannot be determined until the doors have been opened. According to the latest statement of the management there will be 37 exhibitors at the Coliseum, 11 in the Coliseum Annex, 20 at the First Regiment armory and four at the Wilson building, while it is expected that the great majority of the displays of accessories, supplies, equipment and the like will be continued through the second week.

The exhibitors will be the following concerns: Coliseum, Adams Bros. Company, American Locomotive Company, Autocar Company, Buffalo Electric Vehicle Company, Buick Motor Company, Clark Delivery Car Company, Dayton Auto Truck Company, Durant-Dort Carriage Company, Federal Motor Truck Company, General Motors Truck Company, Garford Company, Gramm Motor Truck Company, Hupp Motor Car Company, International Motor Company, Thomas B. Jeffery Company, Kelly-Springfield Motor Truck Company, Kentucky Wagon Manufacturing Company, Kissel Motor Car Company, Knox Automobile Company, Krebs Commercial Car Company, Locomobile Company of America, Mais Motor Truck Company, Mercury Manufacturing Company, Old Reliable Motor Truck Company, Peerless Motor Car Company, Pierce-Arrow Motor Car Company, Pope Manufacturing Company, Reliance Motor Truck Company, Reo Motor Car Company, Selden Motor Vehicle Company, Speedwell Motor Car Company, Studebaker Corporation, Sternberg Manufacturing Company, U. S. Motor Truck Company, Velie Motor Vehicle Company, Walker Vehicle Company, Waverley Company; Coliseum Annex, Bowling Green Motor Car Company, Chase Motor Truck Company, Dart Manufacturing Company, Harder Auto Truck Company, H. J. Koehler Sporting Goods Company, Lippard-Stewart Motor Car Company, M. & P. Electric Vehicle Company, Service Motor Car Company, Standard Motor Truck Company, Transit Motor Truck Company, Inc., Universal Motor Truck Company; First Regiment armory, Avery Company, Baker Motor Vehicle Company, Bessemer Motor Truck Company, Brown Commercial Car Company, Chicago Pneumatic Tool Company, Commerce Motor Car Company, Four Wheel Drive Automobile Company, General Vehicle Company, Gramm-Bernstein Company, Harwood-Barley Manufacturing Company, International Harvester Company, Lauth-Juergens Motor Car Company, National Motor Truck Company, Mogul Motor Truck Company, Packard Motor Car Company, D. F. Poyer & Co., Sanford Motor Truck Company, Schacht Motor Car Company, A. O. Smith Company, White Company; Wilson building, O. Armleder & Co., Driggs-Seabury Ordnance Company, Grand Rapids Motor Truck Company, Randolph Motor Car Company.

Considering the list given above the following did not show at New York: Adams Bros. Company,

Avery Company, Buffalo Electric Vehicle Company, Harder Auto Truck Company, Thomas B. Jeffery Company, Kentucky Wagon Manufacturing Company, M. & P. Electric Vehicle Company, Mercury Manufacturing Company, Old Reliable Motor Truck Company, Reliance Motor Truck Company, Transit Motor Truck Company, Inc., U. S. Motor Truck Company, Walker Vehicle Company, Chicago Pneumatic Tool Company, Commerce Motor Car Company, Four Wheel Drive Automobile Company, National Motor Truck Company, Mogul Motor Truck Company, D. F. Poyer & Co., O. Armleder & Co., Randolph Motor Car Company.

Included in the exhibitors will be these manufacturers of electric vehicles: Baker Motor Vehicle Company, Buffalo Electric Vehicle Company, General Motors Truck Company, General Vehicle Company, Kentucky Wagon Manufacturing Company, M. & P. Electric Vehicle Company, Studebaker Corporation, Walker Vehicle Company, Waverley Company. Of these the Buffalo Electric Vehicle Company, Kentucky Wagon Manufacturing Company, M. & P. Electric Vehicle Company and the Walker Vehicle Company did not show at New York.

So far as the electric vehicle exhibitors are concerned they will not fare as well as they did at the metropolitan exhibition, where they were all located at Grand Central Palace, for they will be seen at both the Coliseum and the armory, and are scattered and not departmentalized.

The displays to be made of accessories, equipment, supplies, etc., will be very complete and it is probable they will be as numerous as at New York, but a distinct feature will be the special body equipment adapted for varying purposes and for facilitating loading and unloading. While many of the manufacturers will have these distinct types installed on their vehicles, some of the makers of bodies will make displays of designs that have been developed by them and which have qualities that recommend them to those who would secure the greatest economy through the operation of their equipment. In connection with these will be seen a number of hoisting dump bodies, operative by manual and motor power, in capacities ranging from one to seven tons.

There will be some attention given to tractors, for several of the manufacturers having displays have begun the production of these, and in the case of a number of others dead wagons have been adapted which may be used in varying forms of haulage. The greatest capacity of the tractors thus far exhibited is 12 tons, and this is a production that can be advantageously used in construction work. No specialization has been made of vehicles suitable for trailers, for there has been but little attention given to the development of this form of equipment.

BOSTON SHOW PROMISES BIG BUSINESS.

THE Boston show of service wagons, which will take place at Mechanics' building, Huntington avenue, March 19-26, will be an exhibition of national proportions which will, however, appeal to the business men of New England and adjacent states and provinces. The Boston shows have always been the opportunity of each year for the agents and representatives to contact with those who were desirous of buying, and for this reason have had all the productiveness of the local exhibition and the magnitude of the national exposition, a combination that must be considered ideal.

The service wagon market will be more active than ever before and with a realization of the demands it is expected that the manufacturers will co-operate with their representatives or agents to make the show the largest and best of the country. No statement has as yet been made by Manager Chester I. Campbell, but it is believed that there will be more makes and more vehicles and chassis shown than at any other show yet held.

The pleasure car show will be concluded March 15 and the building will be closed until the evening of March 19, when the industrial wagon exhibition will be opened. It will continue for six full days and an intervening Sunday. The interval between the shows will give ample time for the arrangement of the exhibits, and permit the exhibitors to rest after the activities of the first show.

The conditions in New England, where the commercial centres are frequent and the highways are exceptionally good, are unusually favorable for the use of the motor vehicle, and a recent statement of registration shows that approximately a seventh of the entire number of service wagons in the United States are owned in these states. With the remarkable interest in business economy, which has been very largely promoted by the educational campaigns for several years, it is believed that there will be a very material increase in vehicles for service, and it is not at all improbable that the total at the end of the year will show a gain in registration of upwards of 50 per cent. The influence of the Boston show in this market is very large and with a knowledge of the possibilities the exhibitors will make every endeavor to insure to themselves the benefits of its productiveness through fine exhibits and high class selling forces.

The Motor Wagon Company of Detroit has decided to add a half-ton truck to its models, having been manufacturing in the past an 800-pound delivery wagon with a two-cycle, two-cylinder engine. The new wagon will be constructed of standard parts and a four-cylinder, four-cycle motor will be utilized. The truck will have a three-speed gear of the selective type and a double side chain drive. The standard body will provide 22 square feet of loading space, the close bodies having 100 square feet of load capacity.

MOTOR TRUCK DELIVERY IN TWO STATES.

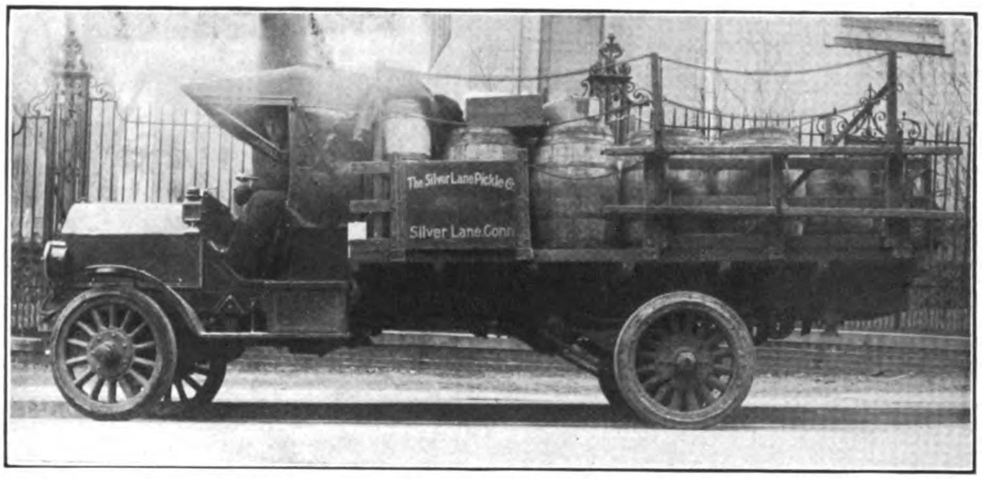
USING a motor truck instead of steam or electric railroad service to make delivery the Silver Lane Pickle Company, Silver Lane, Conn., has made a considerable saving in money and has distributed its products with much better satisfaction to its customers. As the company has owned the machine, a three-ton KisselKar, since last April, and has worked it under all conditions, its experience can be regarded as sufficient to base judgment on the possibilities through its use. The mileage up to the present time is between 8000 and 9000.

The factory of the company is between four and five miles from Hartford, and from this point distribution is made, and the vegetables from which the pickles are made are hauled from the farms in Vernon and Rockville, where about 58 acres of land are cultivated. During the harvesting season the work of the company is very largely increased, for the crops must be brought from the farms to the plant, and this haulage cannot be delayed because of the perishable nature of the vegetables, while at the same time the deliveries must be continued.

The business of the company has extended until it has customers in many of the cities of Connecticut and Massachusetts, and the barrels or other containers must be taken from the factory to the railroad freight station at Hartford or to the trolley freight station by the concern and shipped. The shipments are double tagged and on arrival at the destination are taken by local expressmen and delivered to the customers, who also collect the empty containers, bring them to the freight stations and ship them to the factory.

The business was carried on in this manner so far as deliveries was concerned, save in Hartford, until the company decided to buy the truck. Then as rapidly as plans could be made the machine was used for delivery in the Connecticut river valley as far north as Northampton, a distance of about 50 miles, as far south as New Haven, and to Bridgeport. The run to Bridgeport is the longest thus far made, and while the round trip is 108 miles, the incidental deliveries and collections will bring the mileage to approximately 120. It was found that the machine could be driven from Hartford to Northampton or Bridgeport, making deliveries en route, and return in a single day, and this made it possible to serve customers far better than could be done with any other service, and at the same time developing the business as no other character of attention could do.

To understand the value of this direct delivery it should be known that with the railroad service delays were not only frequent, but at times were of extreme and exasperating length. The packages when received at the destinations were not always promptly hauled, and customers often complained that they were seriously inconvenienced by the failure of orders to reach them in season to properly maintain their stocks. The trolley lines were more satisfactory than the steam railroads, but these were by no means ideal. An instance that well illustrates the conditions so far as railroad transportation are concerned happened when an order of sauer krout was shipped by freight from Hartford to Rockville, a distance of 14 miles, because the truck was not that day available for delivery. Eight days after the shipment a salesman called on the Rockville customer just as an expressman was delivering the order, which could have been sent out by the truck in less than two hours. There could be no more convincing contrast of the desirability of prompt delivery.



KisselKar Three-Ton Truck That Makes Quick Deliveries in Two States for the Silver Lane Pickle Company, Silver Lane, Conn.

The company does a large business with Worcester, Mass., firms, and it is intended the coming spring to send the truck to that city, a distance of about 90 miles, and this will be made a two-day run. The Bridgeport route will also be covered in two days, because the long drives mean hard work for the crew of the truck. Wherever the business will justify and within a radius of 100 miles the truck is to be used for delivery and collection.

The farms at Rockville and Vernon are very productive and last year more than 10,000,000 pickles were brought from them to the factory. The farms are two miles distant from the nearest trolley freight station and before the truck was used the vegetables were hauled to cars and from cars to the factory, necessitating several handlings that caused a considerable damage and loss. Last season the truck was used to haul the crops and it was used practically 24 hours daily during the harvest, two men manning it. It min-

imized handling and the time the crops were on the way, and in this manner worked a great saving, while there was the reduction of the haulage expense to a very large degree. F. C. Gould of the company says that during this period the truck earned more than $50 a day in excess of its operating cost, and this in addition to the economy in other ways.

Mr. Gould regards the truck as being a very wise investment. While it is not maintained there is a great saving in actual cost of freightage, there are many reasons why the machines should be used, but the elimination of breakage, the quick delivery and the better satisfied customers mean business development and cannot be measured by figures. The approximate cost of operating the truck is $12.50 a day, and the total is based on an estimate for a year as follows:

Interest at 5 per cent	$170.00
Insurance	131.00
Depreciation at 20 per cent	680.00
Wages, driver and helper	1456.00
Fuel, lubricants, etc	600.00
Repairs, 10 per cent	340.00
Tires, 10,000 miles guaranteed	250.00
Taxes	68.00
Total	$3695.00
Daily cost, 300 working days	$12.32

As the machine has been used for practically a year the figures given may be accepted as being very close to the actual expense, and not a result of theory. The company had some trouble with the tires used, and it was maintained by the representatives at the maker's branch office at Hartford that the truck was overloaded. An observer was placed on the machine and after investigation it was decided that the tires were overloaded, and not the truck. As a result of the inquiry five-inch dual tires were placed on the rear wheels, and it is believed that the condition has been successfully met.

The roads on which the machine is driven between the factory and Hartford are principally macadam, but better within the city than outside. The main highways are traversed generally and the streets of the cities, so there is no special operating condition. Mr. Gould has owned four Columbia cars and is now driving a machine of that make, and his knowledge of automobiles has been very useful in efficiently operating the truck. The garage is located at the plant at Silver Lane.

STUDEBAKER PLANS FOR 1913.

New Line of Gasoline and Electric Vehicles Will Give Purchasers Wide Range of Selection.

The Studebaker Corporation, Detroit, maker of Studebaker pleasure and commercial vehicles, will greatly increase its truck department for 1913 and will manufacture and market a complete line of gasoline and electrically propelled vehicles varying in size from light delivery wagons to heavy duty trucks. Four chassis types will cover a range from 1500 to 12,000 pounds. The Studebaker designs are by Albert F. Mais, who took charge of this department more than a year ago. During 1912 the company produced more motor driven commercial cars than ever before in its history and the output this year is expected to greatly exceed this.

The electric trucks have to a large extent been redesigned and one model is equipped with worm drive. At first Studebaker trucks will be sold in New York, Boston, Philadelphia, Chicago, Los Angeles and San Francisco through truck departments added to the respective branches, but the service will be greatly extended as soon as arrangements can be completed. The bodies will be built in the company's South Bend plant, where an experience of more than 50 years has developed definite knowledge of load distribution and carrying design.

SPEEDWELL INCREASES CAPITAL.

Adopts Plan Whereby Purchasers of Pleasure Cars May Select New Rotary Valve Motor.

The Speedwell Motor Car Company, Dayton, O., maker of Speedwell trucks and pleasure cars, has arranged a bond issue of $150,000, which has been subscribed. The proposition of increasing the capital stock of the company to $600,000 will be submitted to the stockholders. This bond issue was planned to take care of the extension of the Speedwell product involving the use of Mead rotary valve six-cylinder motors on a portion of the output of the factory.

After tests extending over two years the Speedwell company has taken a license under the Mead patents for the Mead rotary valve motor. While for some time foreign makers have offered the motor car buyer choice of poppet or non-poppet valve motors, the Speedwell company claims to be the pioneer in this country in equipping its cars at the customer's option with either type. The Speedwell car has a standard chassis and the cars will be alike except the power plant, which will be regulated according to the patron's pleasure. A limited number of Mead motors will be built the current season, while a larger output of this type is planned for next year.

REMOVES PLANT TO NEVADA.

Four Traction Auto Company Merges with Nevada Manufacturing Concern to Produce Kato Line.

The Four Traction Auto Company, Mankato, Minn., maker of Kato four-drive trucks, has made the announcement that it has combined with the Nevada Manufacturing Company, Nevada, Ia.

The Four Traction Auto Company has been very successful in the manufacture of its Kato trucks, which have been placed in service in all sections of the country. However, under the merger of the two concerns the company will move much of its equipment to Nevada, where the Kato trucks will in future be manufactured by the Nevada Manufacturing Company.

MOTOR EXPRESS WAGON WORK PROFITABLE.

THE value of a motor vehicle used in combination with horse equipment is seldom realized, and because of the practical results obtained with a one-ton General Vehicle wagon the experience of Downing & Perkins, Hartford, Conn., is of unusual interest. It is a demonstration of the possibilities of increasing business and economizing as well. The firm was established in 1830 and is one of the best known transportation contractors in the state. All its haulage was done with horses until June 10 of last year when the electric was started. With this machine the firm has converted the undesirable business, that which it could hardly afford to reject and from which little or no profit was realized, into profitable patronage.

The mileage capacity of the machine and that it can be worked as many hours as desired, are the principal factors, and while it is extremely useful for any kind of work it is especially productive in trips of considerable length. D. C. Perkins of the firm says that for two years motor vehicles were considered, and while he was not convinced that any machine would do his work satisfactorily, he bought the wagon because he simply had to have something better horses.

The machine was assigned to the long, hard hauls that tire out horses and a good deal of the work that is really special or emergency haulage. Mr. Perkins says that for two months after he started the electric he did not want to look at the books for he was almost certain the showing would be unsatisfactory. But to his surprise he found that June, July and August proved successively more productive. He had utilized it in the work where it would relieve the horses and improve his service, and the result was more than he expected.

He found that where he had to keep an extra horse for each two wagons used, this reserve was unnecessary with the wagon in operation. That when the animals were tired at the end of a day and it was abuse to drive them more, the work could be done with the machine, saving the animals and satisfying the customers.

Mr. Perkins instanced a morning's work. The wagon was sent to the freight yard, three-quarters of a mile from the office, where a load was taken and carried two miles to Chapin place and unloaded; there it took on another load and was driven to Charter Oak Park, three miles distant, unloaded at different points and after taking on a load of fencing was driven to New Britain, about six miles, and returned to the office, making at least 20 miles by 11 in the morning. To do this same work, horses would require at least 12 hours. In haulage speed is necessary to insure a profit and when horses are loaded to their capacity the work cannot be quickly done. He believes that as to efficiency the wagon is at least equal to three horses at their best. Recently the firm sent a heavy casting to Manchester and to do this work with horses a full day would have been required and the charge would have been $7.50, but the wagon made the round trip in a little more than two hours and traversed about 22 miles.

Mr. Perkins finds that besides the utility of the wagon at his command his horses do better work when used considerately. He regards the limitations of the wagon largely a matter of drivers, and when emergency work is needed it can be done. The Saturday before Christmas the wagon was driven 66 miles, being in regular work during the day and delivering mail at night. The following Monday the mileage was 60, and all of it in Hartford. The average work for the horse is 15 miles, and for the wagon from 35 to 40. The driver drove horses before he was given the wagon. Mr. Perkins says that from his experience the wagon is a good investment and that in all probability he will purchase another in the spring. He is not only satisfied with the wagon, but believes the machine is worth $1000 to him from the peace of mind it has afforded him.

He is intensely practical, and he maintains that it is more of a problem to teach the public how to use the motor wagon than to build it. He says that people generally refuse to consider the value of the time of others. Everywhere the machine is sent the driver is

One-Ton General Vehicle Wagon Used by Downing & Perkins, a Hartford, Conn., Transportation Contractor, with Much Success.

compelled to wait. These delays cause serious loss to the owners of automobiles. He cited an instance of where his driver had to wait 90 minutes to unload 12 barrels of sugar, and when he went into the store he had to move three or four loads left by other drivers. Not only this, the owner of the store would not sign for the sugar until it was all within the building.

In considering horse cost Mr. Perkins stated that it costs $5 a day to use a single animal and $6 a day for a two-horse team. Not only this, horse cost has been steadily increasing and the end is not yet. As to the expense of operating the wagon it is maintained that it must earn $2000 a year to be profitable. Between June 10 and Dec. 28 it had earned $1578, or approximately $10.50 a day. The cost of operating the wagon is fixed at $7.50 a day, and if the same ratio of earnings is to continue it will show a profit of $3 a day, and for 300 working days that is $900, or about 45 per cent. on the purchase price. The owners maintain that it will show 25 per cent net profit.

An estimate of the cost of operation is as follows:

Interest at 5 per cent	$101.25
Depreciation at 10 per cent	202.50
Upkeep and repairs at 10 per cent	202.50
Tires, guaranteed for 10,000 miles	175.00
Liability insurance	110.00
Taxes	40.50
Garage service	120.00
Battery service	252.00
Driver, wages	700.00
Total	$1903.75
Daily cost	$6.35

The firm does not keep the machine in its stable, but stores it in the garage of the Commercial Electric Vehicle Company in Main street, where it is washed. The battery is not owned by Downing & Perkins, but is rented from the Hartford Electric Light Company. This plan requires the payment of a service charge and a stated price for each mile a battery is used in a wagon or truck, but the greater the mileage the expense is relatively lessened. The battery may be changed as often as it is necessary and the machine may be used continuously when wanted.

TO PRODUCE HINDLEY WORMS.

Otis Elevator Transfers Its Interest in Their Manufacture to a Separate Corporation.

The designing and manufacturing of worm gearing of the Hindley type, which has been a branch of the business conducted by the Otis Elevator Company, Philadelphia, Penn., has been discontinued by that company as such and since Jan. 1 has been taken over by the Hindley Gear Company, a corporation organized under the laws of Pennsylvania.

The increase in this line of work has reached such proportions that the Otis Elevator Company's officials believe their customers would be better served by having a separate concern take care of it, particularly in view of the increased demand for this type in commercial vehicles.

AN APPRECIATION OF W. H. BLOOD, JR.

Electric Vehicle Association Honors Its First President by Complimentary Banquet.

An event of unusual pleasure to those present was the complimentary banquet tendered by the Electric Vehicle Association of America to the first president of that organization, W. H. Blood, Jr., of Boston, at Delmonico's, New York City, the evening of Jan. 16. The plans for the occasion were made to insure the presence of a large number of electric vehicle and central station men, and the company was in every way representative.

The toastmaster was Arthur Williams, who succeeded Mr. Blood as the executive of the association, and in proposing a toast to Mr. Blood he emphasized the admirable work of the guest of honor in developing the association. Mr. Blood in his response pointed out the influence of the organization and the possibilities for the future, stating that its membership now represented more than $500,000,000 capital, all directly interested in the utilization of electrical energy for light, power and heat. A number of letters and telegrams from prominent persons who were unable to be present were read.

There was abundant entertainment, both vocal and instrumental music, including several tenor solos by Thomas E. Murray, vice president and general manager of the New York Edison Company, and several professional entertainers added interest to the evening. The company included:

G. H. Atkin, W. H. Atkins, R. A. Bachman, E. W. M. Bailey, Day Baker, John H. Barker, H. H. Barnes, J. Crawford Bartlett, John J. Bartram, A. K. Baylor, Jos. F. Becker, W. G. Bee, Theodore Beran, Jean E. Blaise, Chas. Blizard, A. Bourquardez, Walter R. Boyd, Nicholas F. Brady, M. J. Brayton, C. H. Brennan, G. W. Brine, Geo. H. Buzby, J. H. Cafferty, F. N. Carle, E. A. Carolan, M. B. Chase, J. S. Codman, L. A. Coleman, Frederick G. Cooper, H. C. Cushing, Jr., E. W. Curtis, Jr., Robt. W. Daniels, H. L. Davisson, James C. DeLong, F. S. Dellenbaugh, Jr., Geo. Davies, Hayden Eames, C. L. Edgar, L. L. Edgar, Dudley Farrand, Henry C. Fling, W. H. Francis, W. W. Freeman, F. W. Frueauff, F. S. Gassaway, E. C. Geither, J. F. Gilchrist, Albert Goldman, E. W. Goldschmidt, J. H. Goehst, Uri B. Grannis, Emlen S. Hare, Geo. H. Harries, Henry R. Hayes, Geo. W. Hill, H. W. Hillman, Geo. W. Holden, W. E. Holland, Welles E. Holmes, S. B. Howard, J. T. Hutchings, Wm. Illch, W. H. Johnson, T. I. Jones, J. Kelly, Geo. H. Kelly, Wm. P. Kennedy, F. M. Kimball, G. G. Laird, J. M. Lansden, C. L. Law, J. W. Lieb, Jr., Arthur B. Lisle, C. A. Littlefield, R. McA. Lloyd, R. L. Lloyd, Ernest Lunn, Frank S. Marr, E. S. Mansfield, Hal Marchbanks, Converse D. Marsh, T. C. Martin, Arthur Miller, Jos. T. Maxwell, W. E. McCoy, W. D. McJunkin, C. E. Michel, John B. Miller, E. A. Mills, Jos. B. Murray, Thos. E. Murray, S. St. I. Morgan, C. A. Musselman, C. Nast, A. F. Neale, F. B. Neely, Walter Neumuller, E. A. Norman, R. C. Norton, W. H. Onken, Jr., R. F. Pack, Geo. F. Parker, Wm. H. Patton, F. F. Phillips, Chas. W. Price, E. L. Reynolds, H. H. Rice, Jesse Richards, Harvey Robinson, E. J. Ross, Jr., Robt. E. Russell, H. T. Sands, F. F. Sampson, Robt. M. Searle, Chas. S. Shepard, M. A. Singer, Frank W. Smith, H. H. Smith, C. W. Squires, Jr., W. G. Stetson, Chas. W. Stone, Frank J. Stone, W. B. Stoughton, Dan Swander, F. M. Tait, Albert Taylor, C. I. Taylor, A. B. Tenney, C. G. M. Thomas, S. G. Thompson, H. F. Thomson, W. G. Tucker, Jr., E. F. Tweedy, P. D. Wagoner, J. M. Wakeman, L. R. Wallis, C. A. Ward, C. E. Watrous, W. F. Wells, G. W. Wesley, F. R. White, W. H. Whitton, C. L. F. Wieber, Arthur Williams, Edward T. Williams, Hugh M. Wilson, O. D. Young, P. S. Young, R. R. Young.

The Alco truck that recently made the transcontinental run was driven from Philadelphia to New York Jan. 16, carrying 30 boxes of soap, in eight hours and 31 minutes, this being 14 minutes less than the trip had been made by a service wagon.

MILLER PROPOSES SUMMER TRUCK SHOWS.

THE suggestion is made by Charles E. Miller of New York, who is the largest as well as the pioneer accessory and supply dealer of America, who was one of the committee that arranged the first motor vehicle exhibition for New York, that the show of service vehicles should be made during the summer of early autumn, and that it should take place where demonstrations can be made.

While Mr. Miller has made no outline of his proposal it has every quality to recommend it to the serious attention of all makers of vehicles built for freight transportation, and in line with the suggestion is the assumption that the place for exhibition should be where there will be a suitable enclosure and sufficient area for demonstrating. This would seemingly require a place such as might be found within a trotting park, an agricultural ground, or, possibly, within a speedway, where a track might be available for operation of the vehicles at different times, and where there could be trials of different kinds that would be of an educational character.

In connection with this it would be possible to demonstrate the practical use of all forms of body equipment, the possibilities of quick loading and unloading bodies, the economies of special loading facilities, and the practical results to be obtained from governing devices and other forms of control, the efficiency of brakes and such other qualities as are regarded as essential.

It is not to be assumed that one exhibition of this character would suffice for the United States, but it is certain enough that such a number as would be justified by conditions could be arranged. So far as accessories and the like are concerned it has been very effectively demonstrated that the volume of business transacted during the showing of service wagons is not sufficient to warrant any great anxiety on the part of those who manufacture or distribute them.

Considered from the practical point of view such an exhibition should logically be held in the summer or autumn, but it might be said that the time could be determined with reference to the climatic conditions rather than to specific dates. For instance, if held in different parts of the country, it might be possible to arrange a series of such exhibitions, and, if desirable, travel could be made by road instead of by railroad. To be sure there would be no ornate surroundings and nothing to attract the eye, but the setting of a business man's show could well be bare walls or fences if the merits of the exhibits were such as to interest.

FISK TIRE COMPANY AFFAIRS.

Reorganization as Massachusetts Corporation with Capital of $15,000,000—Willys Purchases Stock.

John N. Willys, president of the Willys-Overland Company, Detroit, maker of Overland cars, and who controls an interest in several pleasure and commercial vehicle concerns, including the Gramm Motor Truck Company and the Garford Company, has purchased an interest in the Fisk Rubber Company, Chicopee Falls, Mass., maker of Fisk tires, according to a recent announcement. It is also stated that Mr. Willys' purchase is merely in the nature of an investment in a substantial concern and he will take no active part in its management, or become an officer or director of the firm.

Harry T. Dunn, president of the Fisk Rubber Company, has issued a statement to the effect that he and Harry G. Fisk, secretary-treasurer of the company, will materially increase their holdings and will remain in full charge of the concern, which will retain its individuality. It is also stated that the Fisk company is a Delaware corporation, but a Massachusetts corporation is in process of organization and practically completed, with an authorized capital of $15,000,000, of which $5,000,000 is first preferred stock, $3,000,000 of which will be issued; $2,000,000 second preferred and $8,000,000 common. The Massachusetts corporation will acquire all of the assets of the Delaware concern in the immediate future. The Massachusetts Fisk Rubber Company's active management will be identical with the present management of the Delaware concern.

WANT MOTOR TRUCK CONTEST.

Two National Associations Considering Plans for Holding Reliability Run and Open Air Show.

At the recent meeting of the American Automobile Association at New York City, formal notice was given the agitation for an annual reliability event for motor trucks, said to have had its inception at Detroit. The question was brought forward in the form of a resolution, which was adopted, authorizing the president to appoint a committee to discuss the matter with the National Association of Automobile Manufacturers, and if sufficient support in the form of a representative entry list is forthcoming the president is further empowered to appoint a committee and otherwise arrange for such an event during the coming summer.

The form of contest to be recommended is not known, but William E. Metzger, a member of the American Automobile Association's executive committee and president of the National Association of Automobile Manufacturers, favored the application which was made for a national non-stop run to be conducted at Detroit at the time of the Michigan state fair, with an open air motor truck exhibition to be held on the state fair grounds.

The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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COST OF MOTOR FUEL.

A great deal of concern has been manifested in the cost of fuel for explosive vehicle engines. The price of gasoline has increased very much within a comparatively short time. There is a limit to the production unless markets can be found for the other products from refining crude mineral oils, and the supply establishes the market prices. Other fuels are available, but they are not practical with the present types of carburetors.

Kerosene is a logical substitute and the only reason that militates against its use is the difficulty of initial carburetion. Kerosene will vaporize with agitation at 90 degrees, and starting is easy at 100 degrees of temperature. Heating a carburetor to afford vaporization is one possibility and starting with gasoline and changing to kerosene, is another, using the types of carburetors and engines now the vogue.

Alcohol is a practical fuel with differently designed engines and carburetors. While alcohol is now more expensive than either kerosene or gasoline, this is because there has been so little demand for it. Alcohol requires a higher compression motor with the accompanying results from such construction.

Kerosene, however, will be for a long period a cheap and certain fuel. The manufacturers of carburetors, engines, vehicles and producers of kerosene have the same interest in practically utilizing it, and the time to perfect carburetion is now.

PROGRESS IN TRUCK BUILDING.

Examination of the service wagons exhibited at the New York display impressed upon observers that the engineers and manufacturers have given great attention to perfection of existing models to insure endurance and longevity. With the majority of the builders the purpose has been to increase the strength and proportions of members to resist the usual causes of deterioration, for there has been keen realization that constructions intended for fast haulage are subject to excessive road stresses, especially when driven light. The improvement of the machines does not mean radical changes, but to the contrary there has been a careful development of designs to meet the requirements evident through experience and continued observation.

The makers of heavy vehicles have generally perfected body equipment with a view of facilitating loading and unloading, while the builders of the smaller types have thus far apparently relied upon speed as being the main factor in economic work. One thing especially noticeable was the increased accessibility of the mechanisms, and the adaptations to minimize labor for care and maintenance and to reduce the time that a vehicle need be withdrawn from service for repair or overhaul.

LIMITING VEHICLE WEIGHT.

The bill limiting the weight of motor trucks, the loads that can be carried by them and the sizes of tires, which was last year referred by the Massachusetts legislature to this year's session of that body, has been sponsored by the state highway commission. One of the reasons given by those favoring its passage is the general character of the bridges of the main highways outside of the cities, and another is the destructive effects of motor vehicle traffic on the roads.

The motor vehicle owners and users of Massachusetts paid to the state in fees of different kinds last year considerably in excess of $600,000, the greater part of which was applied to the use of the highway commission, and this in addition to the regular taxes.

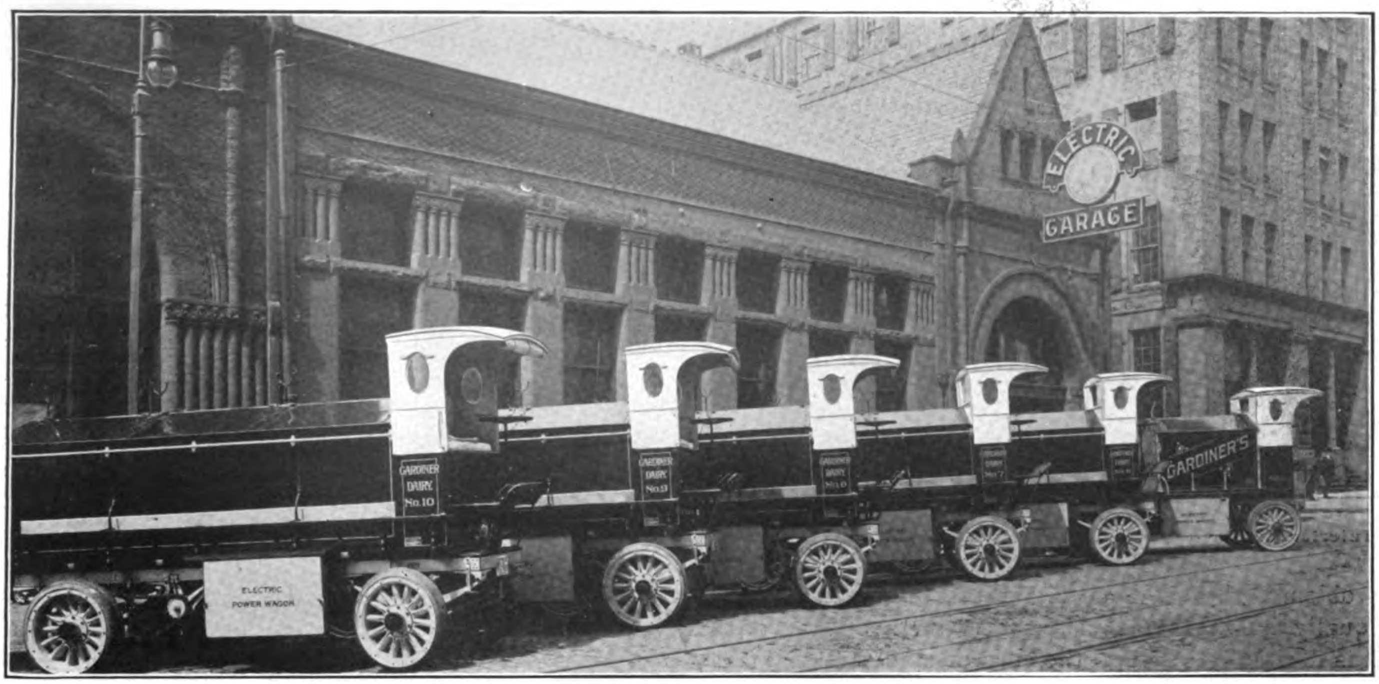
The highway commission is willing to advocate what will lessen the taxes in the towns, and especially benefit the town residents. It now proposes to go even further and to insure the towns against such bridge improvements as might be necessary eventually to meet the demands of highway vehicles. As the chief value of the motor freight vehicle is its increased load capacity, and its speed seldom if ever reaches the rate at which the most radical can assume roads are worn abnormally, the highway commission of Massachusetts seemingly proposes to legislate from the business interests of the state practically all the economies possible in haulage by restricting the use of motor trucks.

CENTRAL STATION PUBLIC GARAGE.

Consolidated Gas Electric Light and Power Company, Baltimore, Md., Has Organization for Selling, and Facilities for Maintaining Vehicles That It Sells, and Systematically Promotes the Use of Electric Wagons.

By William W. Scott.

THE attitude of the central station—that is, the public service corporation supplying electric energy for power, light and heating—has a vast influence in the promotion of the use of the electric vehicle for service and for pleasure. It is a fact that the interests of the central stations, the wagon and car manufacturers and distributors, and the owners and users of machines are so interwoven that it is only through the intelligent co-operation of all these that the fullest measure of promotive endeavor may be realized. There will be no issue taken with the statement that the central station is the most important of all factors in the development of highway haulage, and that there will be results proportionate to the activity of the managements and their willingness to co-operate, because it is certain that only through the actual knowledge of the extent of this co-operation will those who can use electric vehicles decide upon them.



Exterior of the Garage of the Consolidated Gas Electric Light & Power Company, 30 South Eutaw Street, Baltimore, Md.

Wherever a central station is in operation, and there are close to 30,000 of them in America, electric energy is produced commercially, and its use is promoted. The electric vehicle affords a distinct market for energy of such importance that it must impel attention. But it is obvious that this source of revenue will only be what the central stations will make it. It would be possible for the owner of a machine to install his own charging plant and produce the current he would use, but this would entail investment, care, maintenance, and would involve his engaging in another enterprise that would be foreign to his business, unless it were necessary for him to create power. Where there is one person who might feel justified in installing a plant of this kind there are hundreds who would not, and it is evident that such installations would not affect the revenues of the central stations.

The concerns who are large producers of power would undoubtedly establish their own plants and such as these could not be regarded as prospective consumers of energy, but those who utilize current for lighting and power can be logically considered the prospects for business, provided they have use for delivery service. There is no question of the economic possibilities of the electric vehicle for innumerable purposes. The central station is usually located advantageously for the distribution of current, often in the centre of the business section of the community which is served, and there is but little construction or expense necessary in the extension of the mains or lines for supplying a public or private garage. There is reason to assume that any central station will make whatever extension of its lines is necessary when a customer is assured, and will encourage business that will insure a constant and a satisfactory revenue.

For a number of years, especially in the centres of population, the central stations have devoted much time and endeavor, generally with carefully consid-

ered system, toward the promotion of the use of current, and have encouraged household consumption. It has been necessary to have station equipment to supply the heaviest demand of the day, with a reasonable reserve production to meet exigencies, and the period or moment when the largest volume of energy is consumed is known as the "peak" of the "load." Naturally the "load" varies considerably, and is ordinarily smallest between midnight and the early morning hours, probably from 12 to 7 daily. The problem with practically all stations is to increase the consumption of energy when it can best be supplied, and to develop the use of current during the "off-peak" period.

Power consumption is generally during the working hours of the day, and the lighting load varies according to the season of the year, so that while power requirements and lighting service can be fairly accurately determined, there is a variance of the demands upon the central station. To equalize the consumption is the problem with every central station, and is regarded as equally important as increasing it. In other words, it is desirable to sell all the current made and to make as much as is possible. The central stations have generally organizations for promoting the sale of power and lighting, and in many cases for the development of household consumption. The production of energy for electric vehicles has presented very large possibilities, and it is with this—at least the commercial aspect—that this article has to do.

Interior of the Consolidated Gas Electric Light & Power Company's Garage from Near the Office Door.

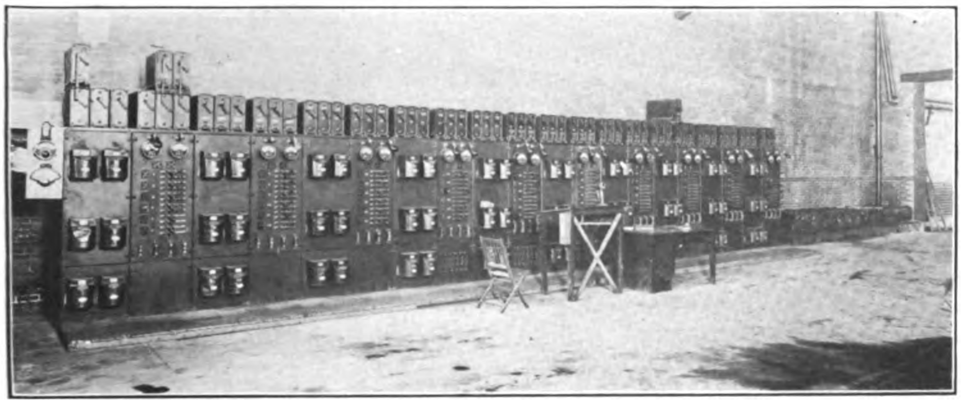
The electric service wagon is used, with comparatively few exceptions, by day. It is not unreasonable to assume that from 6 in the morning to 8 in the evening will cover the ordinary period of use of at least 95 per cent. of all business vehicles. Probably the time from 7 to 6 will include 80 per cent. of all, so that a comparatively small number would be worked earlier or later than the hours named. Between 6 in the evening and 7 in the morning the power load is relatively low, and the consumption for lighting is largest from dusk to 11 at night, leaving the time from 11 until 6 or 7 in the morning, when the load is the lowest. These statements are well enough known to the managements of the central stations, and the facts may differ somewhat in each community, but the proposition as it is presented is intended to inform those who may not be familiar with central station problems.

The central station has need for its own transportation service, this including fuel, material, construction work, maintenance work, as well as the distribution of supplies used by its customers. Thousands of stations today are using horses, and several hundred have installed electric wagons. Those having motor vehicles have found it economical to establish their own garages, where the machines may be charged and given the care and maintenance necessary. Several have established public stations in connection with their garages and are offering to the public the same service given to their own vehicles.

There are those who will maintain that the central station cannot be expected to engage in a public garage business, and that it is an undertaking for the individual who can specialize in this work, but there are innumerable reasons why this assertion is not well founded—at least as is the conduct of a garage for the care of gasoline vehicles. Those who have had the longest experience with garages for electric service wagons maintain that it is more economical for the man who owns less than a dozen machines to patronize the public station, because of the comparatively few men necessary to give the service. That is to say, that the same number of men required to care for and maintain 12 vehicles could, under normal conditions, give equally good attention to 50, and that the larger the number of wagons in a station the actual expense a wagon is relatively less.

Assuming that the central station finds it necessary to establish its own garage, it would be possible to serve the public to a standard that could not be given by the individual enterprise, and the patronage that could be developed would be more productive of revenue as it was developed. That is, it would require a stated expense to garage and care for its own service, and there would be a revenue that would be the more profitable as the number of machines increased. It is fair to assume that any central station would insist upon a satisfactory and economical upkeep of its equipment, and this would be the character of attention that would attract and impel the patronage of others.

The central station has numerous reasons to utilize electric vehicles. First of all it must have suf-



The Charging Board of the Garage, Which Will Charge 60 Batteries Simultaneously.

the radius of their movement, and they have sufficient speed to meet practically all requirements. There are possibilities of other forms of vehicles being the better adapted to certain works, but this is far from being the rule.

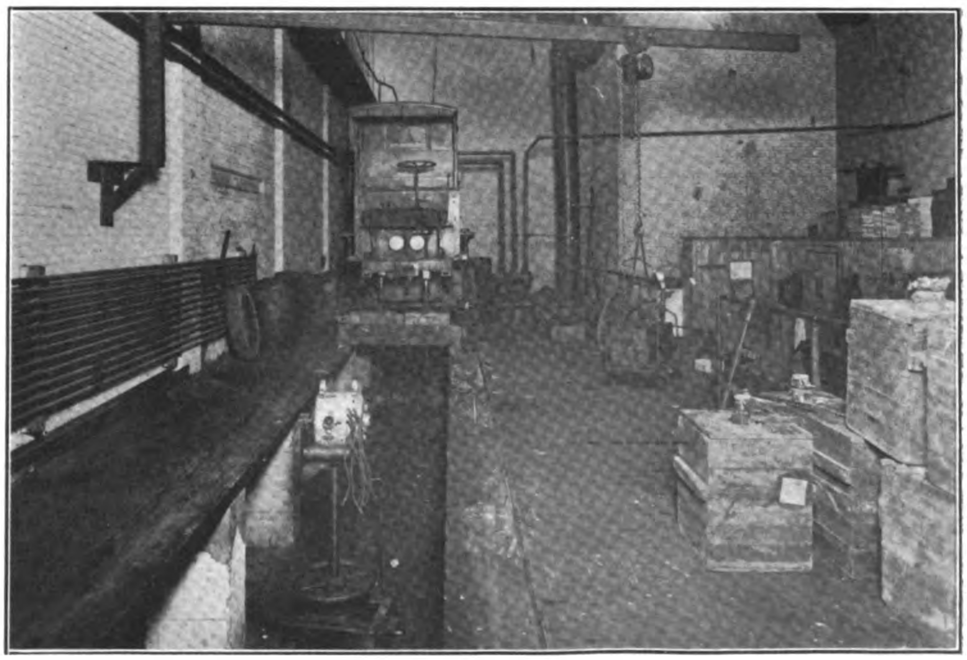
It is certain enough that the central station can and does develop its business. Many have splendid organizations that are constantly developing every possibility commercially. There is probably not one that would refuse consideration of an order from the owner of a single vehicle for current. Every encouragement would be given this character of business. To afford such service would entail more or less expense for construction and the owner would have to install the necessary equipment. With reference to the pleasure vehicle the private garage is often desired by the individual, but with service wagons, requiring daily charging and systematic attention, there is no doubt that a public electric station can better and more economically serve the owner than can any small organization he can establish.

To illustrate: The business man considering the purchase of electric vehicles desires to avail himself of their fullest economy. He may have what will serve as a garage, but to charge the batteries he will have to install equipment that should only be handled by a competent man. To use two or three machines would require as complete an organization as would be needed to use a score. He can obtain such a service at a public station at a really smaller expense, or perhaps a better service at no greater expense. The public electric garages are comparatively few, and the

ficient transportation, it can economically employ machines as against animals, it can secure a considerable advertising service through them, it can use its own energy at minimum expense, it can improve its service so far as construction and maintenance works are concerned, it must have available men who can be trusted with some of the work and it is not necessary to greatly augment the number of employees, it has facilities that can be used for maintaining its vehicles, it has organization that can satisfactorily supervise the service without increased expense, it has no necessity for increasing the overhead expenditures, and in addition to these it may be pointed out that there is a possibility of devoting its endeavors systematically to the promotion of the use of machines by others, increasing the consumption of current and supplying energy at a time of the day when it will really cost the least.

The sale of current during the "off-peak" period for electric vehicle charging really covers the greater part of the night for machines that are used for business by day. The average battery may be fully charged in approximately seven hours, but it is not always necessary to use the full charge, though it is best to charge and discharge it as completely as this may be done. The time of charging may be adapted to that part of the night when it can best be done, so long as the machines shall be in readiness for service when needed. By this is meant that it is not necessary to begin charging at any stated time, as with lighting or with power service. With the private garage or the public station, however, charging is usually begun early in the evening, as quickly as the vehicles are available, but this custom is not necessarily followed in the central station garage.

Relative to the utilization of electric machines by the central station it may be pointed out that for the lighting and power service, with rare exceptions, all of the work is within



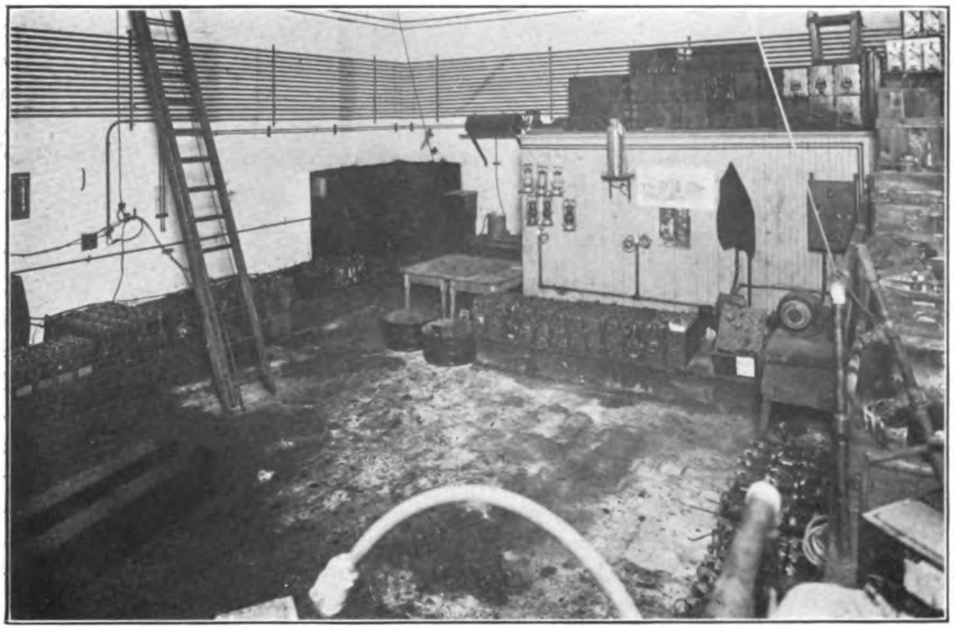
Repair Shop, Showing the Pit Under the Wooden Floor That Will Take Five Wagons, the Motor Jack and the Derrick for Handling Batteries and Heavy Weights.

general garages that afford electric vehicle service are not common. The man who utilizes electric machines must either provide his own facilities for caring for and maintaining them or accept what may be indifferent or inadequate service. But were it possible for him to rely upon the central station for a satisfactory garage service, such as could be maintained for the vehicular equipment of the station, this would bring about a condition that would undoubtedly promote the use of electric machines and insure the sale of current at a period when it could be most advantageously furnished.

The number of electric vehicles that will be sold undoubtedly will be greatly influenced by the attitude of the central stations, because many men will regard the service possibilities as being largely dependent upon the co-operation they shall receive from the stations. In fact they may be consistently regarded as the principal factor in promotion of electric wagon use and, as viewed by the public, are to benefit directly through the sale of current. That eventually there will be electric garages, or garages that will afford service for all classes of machines, there is no doubt, but the individuals who will establish such stations without co-operation from the central station and without sufficient prospective customers to justify such enterprises are far from numerous. Stated in another way, the central station can maintain a garage in connection with its own service and stimulate the use of machines and the sale of current, which ought to be a no inconsequential source of revenue.

A striking example of the possibilities of this cooperation and the results accomplished through a public service afforded at its garage is the development of electric vehicle use in Baltimore, Md., where the Consolidated Gas Electric Light & Power Company has inaugurated a systematic campaign of general promotion. The company has taken up the electric vehicle as a means for insuring the sale of current and has by progressive methods achieved a large measure of success. The company has formulated a policy that is in keeping with its progressiveness, and it has the agency of the General Vehicle Company for that city and vicinity. That is, the company has realized the need of stimulative and promotive endeavors and has organized a division that is devoted not only to the sale of vehicles, but it is affording a service that will make it possible for the man who owns a single machine to operate it at the same relative economy as the concern that possesses a large number.

The commercial department of the company is devoted to the promotion of the sale of electric energy for varying purposes, and included in this is the agency for the vehicles and the administration of the garage. The garage is at 30 South Eutaw street, where service is given for 48 machines aside from the company's electric transportation equipment. The company uses 21 machines and has three more ordered which will shortly be delivered. Two years ago the company had no electric vehicles and it was decided to utilize a number, the first order being for six. This necessitated the inauguration of an electric garage. The possibilities of an agency for machines were considered and believed to be such as to justify the company adding this to its regular business. The value of a public garage for the people who were regarded prospective purchasers and customers was realized and this was provided and was opened for business July 1, 1911.


Battery Room, Included with the Repair Shop, and Its Facilities for Restoration and Charging.

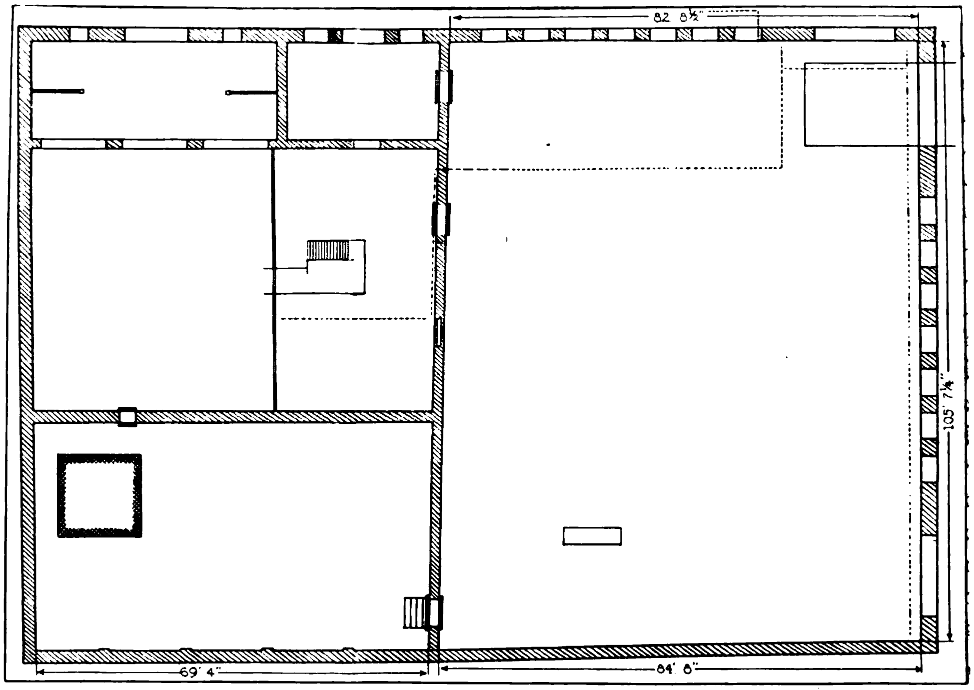
In establishing a garage provision was made for storing and serving about 100 machines, and a power house was turned over to the department by the company. This has a frontage of practically 108 feet and a depth of 157 feet, the power room affording a floor space 105 feet 7.25 inches by 84 feet 9 inches, with abundant light from the front. Over this is a pitch roof supported by trusses, so that the floor is unobstructed. At the rear of this is a heavy brick wall and through this what was the boiler room is entered. This is 69 feet four inches by 32 feet, in which is a chimney stack, and is now a repair shop and battery room. At the other side of the building is a room 27 feet two inches by 17 feet five inches, that is used as an office. The remainder of the structure is used for other purposes, but it is available in the event of need for expansion.

The boiler room floor is considerably below the level of the garage and so a floor or deck was laid over about half the area, this leaving the lower por-

tion for a battery room. An open space four feet wide was left in the floor close to the side wall, and this serves as a pit, as four or five machines can be run over it and worked on with perfect freedom and abundant light. The entrance to the garage is through a wide doorway by a run and the entire floor is concreted and is arranged so that it will drain when flushed. The charging panel or board, which will permit charging 60 batteries simultaneously, extends along the end wall farthest from the entrance. At either side of the garage proper is a concrete barrier which will prevent a vehicle being driven or backed against a wall, and insures sufficient space between the machines and the walls for work to be done. The charging mains extend along these walls and from them at frequent intervals leads and receptacles are provided. Convenient to the main entrance is the washstand, which will take three machines at one time. In several parts of the main floor are fire plugs, so that there is more than the usual fire protection. The building itself is practically fireproof, the walls being of brick and stone, with roof of tile set into steel frames and supported by the truss work. Practically the only thing about the structure that may be burned is the wooden framed window sash. There are fireproof doors between the garage and the battery room and repair shop, and in this section is the wooden deck or flooring, the wooden stock room, the benches and a closet or two. Were a fire to originate in this part of the garage it could not possibly do damage outside of it, and with the usually complete fire protection there is very little probability of loss from this cause.

The description of this garage has been given with the purpose of showing the policy of the company. The station is not in any sense cheap, nor is it a temporary proposition. There is surely not an electric garage in America that is better equipped and there is not one of greater capacity under a single roof. With reference to fire protection it is in a class by itself. Not only this, the building is modern and it will serve for a long period of years. There is possibility of expansion by taking over the remainder of the ground floor, which would probably accommodate about 60 machines, while it would be possible to construct a second floor that would probably afford space for as many more. So with comparatively small expense the company is in a position to provide service for from 225 to 250 machines in all, or about three times the number it now garages. This possibility of expansion is a very important factor and it will be seen that this increase of service can be provided without largely increased rental or additional taxation, while the nature of the building makes possible the minimum of insurance.

Having decided to establish the station the company selected what will insure every element of protection and safety as well as the care and attention. It is almost needless to say the equipment is equally high grade. While it is not necessary to have a large machine shop, with the regular facilities of the company open to it, the battery room, for instance, is fitted with a small motor generator for charging ignition batteries and series of vehicle battery cells, besides the regular charging leads and receptacles; and there are ample facilities for washing, testing, building and repairing batteries. In the repair pit is a motor jack on wheels, so that a motor may be taken from a chassis, lowered and moved as desired, while a derrick with a swinging arm and variable chain hoist is



Plan of the Electric Garage of the Consolidated Gas Electric Light & Power Company, 30 South Eutaw Street, Baltimore, Md.

mounted on the wall and adapted for innumerable purposes. Batteries are removed from the machines in the main floor and taken into the battery room on trucks, and are lifted and swung from the floor to any desired position. This facilitates handling and saves much labor. A glance at the accompanying illustration will show the repair pit, the motor jack and the derrick, and some of the uses made of them.

In considering the sales agency and garage department of this company it is proposed to follow sequentially the sale and use of vehicles, giving the forms of records used and the organization that is necessary to afford the service the company has established. The department is under the management of Douglass Burnett, executive of the commercial department, and the garage is managed by Harrison W. Wagner, who is assisted by a salesman in the agency department. These two men devote themselves to the exploitation

DRIVER'S REPORT.

Wagon No.______ **Date**________________**191** .

Time Out________ **Time In**________

Odometer A. M.______ **P. M.**______

Report on Condition of Car ____________________

Signed________________

Driver's Report, on Card Five by Three Inches, Ruled for 10 Lines and a Heading.

of the machines, Mr. Wagner giving whatever time is necessary to the supervision of the garage.

The sale of an electric vehicle is consummated by the acceptance by a purchaser of a proposal, which is made on a regular form, this requiring the delivery f. o. b. at Long Island City, N. Y., of a specified chassis and body, the terms being the payment of 25 per cent. upon execution of the contract and the remainder upon delivery. The vehicles are sold under the standard warranty of the manufacturer, but the company, acting as sales agent for the General Vehicle Company, guarantees to protect the purchaser under the warranty and on its own behalf, independently of the General Vehicle Company, and agrees to maintain in good running order for a period of one year from date of purchase the batteries and motors of all vehicles kept at the company's garage and operated normally according to the company's instructions. But the company does not accept any responsibility in connection with any vehicles when they have been altered or repaired outside of the company's garage, in cases where the machines are kept at the company's garage. It is also stipulated that when experts are furnished by the company for instruction purposes, they shall, while so employed, act solely at the risk and as agents of the purchaser. There are clauses which specify the company shall not be liable for consequential damage and for delays beyond the reasonable control of the company, and that the proposal is not binding unless accepted within 15 days of submission. There is also a provision that the proposal constitutes in all respects the agreement between the parties and no modification shall be binding unless it shall be executed by the purchaser and approved by the company.

The purchase having been made the garage service of the company is open to the purchaser under yearly contract. This contract states the following prices for the differing types of vehicles:

Capacity, Vehicles of General Vehicle Co.	Battery, No. of Plates a Cell.	Storage, Washing, Oiling, Inspection.	Monthly Charge for Current for Charging Each Battery.	Current for Charging Each Spare Battery.	Extra Battery Charging an Hour for Extra Charges to Make Additional Mileage.
700 lbs.	9 G. V.	$15	$10	$10	10c
1,000 lbs.	11 G. V.	18	12	10	12c
2,000 lbs.	15 G. V.	22	14	10	14c
4,000 lbs.	17 G. V.	26	19	10	19c
7,000 lbs.	21 G. V.	30	29	10	29c
10,000 lbs.	25 G. V.	30	29	10	29c

For repairs it is stipulated that an extra price will be made for all repair labor and material, according to the work done and the supplies furnished, except such maintenance of batteries and motors as may be furnished without extra charge under the contract covering the sale of the wagons.

The company will store, wash, oil and inspect electric power wagons sold by it and manufactured by the General Vehicle Company, and any extra batteries used with them, as listed above, and will furnish the electric charging of the machines. It will furnish electric current and will charge each battery in each wagon after the return from the day's work, using due diligence to make full charges, it being understood that at least eight hours is required for a full charge, according to the prices given. The company will furnish extra battery charges for additional mileage within any 24 hours at notice from the customer or his driver at the prices stated, the current to be supplied at not to exceed twice the normal charging rate (it being stated that each hour's charge so given should add about 20 per cent. to the day's mileage). The company agrees to furnish competent attendants and supervision over the operation and maintenance of the batteries and wagons while at the company's garage. It will also keep on file at its garage records of the mileage, charging current and inspections of all vehicles kept at its garage, which records are open to inspection by the owners of such vehicles. The company specifies that it does not insure the vehicles of

G-1-500

Electric Garage—30 S. Eutaw St.

Daily Repair & Charging Instruction Sheet.

Date____________**19**____

Wagon No.	Repairs To Be Made	Noted By	Charging Instructions	Noted By

Signed.

Daily Repair and Instruction Sheet, Ruled for 22 Entries, in Black on White Paper, 10.5 Inches Length and Eight Inches Width.

O

45 **REPAIR TAG**

CONSOLIDATED GAS ELECTRIC LIGHT & POWER CO. OF BALTIMORE

Electric Garage

30 S. Eutaw Street

Size

Location

Wagon No.

Requisition No.

45 **CLAIM CHECK**

Electric Garage

30 S. Eutaw Street

Wagon No.

Repair Tag, Manila Paper, Eight Inches Length and 3.75 Inches Width, Perforated for Check Two Inches Length.

customers, that it shall not be liable for any loss, damage, or expense occasioned by its failure to supply electric current for any cause save willful neglect or default; that it shall not be liable for consequential damage, and that from the failure of the customer to comply with the provisions of the contract, or terms or conditions, or default of payment for service beyond 30 days, it may discontinue the service without incurring liability for any loss or damage. The contract specifies the number of vehicles and extra batteries to be cared for, and service is begun at noon of a given day and continues for a year, the bills to be payable monthly 10 days after rendition, and are to be sent to a stated address. When the service specified by the contract has been used for more than a year the contract may be terminated in 10 days by written notice from either contractor. The contract is not modified unless such modification is in writing and attached thereto.

The contract has been dealt with to considerable length from the fact that it calls for a year's service, and after that time it may be continued an indefinite period, terminable at 10 days' notice. This differs from the usual custom of garages, which is generally a monthly rate and for no stated period. While the charge for current is, according to the contract, a flat rate for a given capacity of vehicle, the American Express Company, which keeps its fleet of 25 machines at the garage, pays for the current used on the basis of kilowatt-hours, for which a charge is made of four cents a kilowatt. It will be seen, however, that under the contract the company will fully charge the batteries after each day's use.

The service of the garage is standard and it is admirably systematized. The organization includes Manager Harrison W. Wagner, his assistant in the sales department, a clerk, a garage foreman, day and night switchboard men, head battery man, assistant battery man and two helpers; three men who water batteries and oil and grease the wagons, day mechanic and helper, night mechanic and helper, two washers and a porter. The day "crew," outside of the office, consists of a foreman, switchboard man, battery man, assistant batteryman, mechanic and helper, and a battery man who works from 2 in the afternoon until 11 at night; the night "crew" includes a switchboard man, battery man, mechanic and helper, the helpers who water batteries and oil and grease, and two washers.

In the contract of sale of vehicles the company undertakes to give attention to the batteries and motors for a period of a year, and to insure the care necessary in charging what is known as a battery charging sheet is posted in the garage. This specifies the vehicles kept at the garage and the size and type of the batteries and the charging rate for each. It is necessary that this instruction be followed implicitly, and the order is signed by the garage manager and approved by the manager of the commercial department. A copy of this sheet is of interest:

Wagons	Battery Size		Charging Rate
Company, 700 lbs.	9 GV		13- 5
Company, 1000 lbs.	13 GVS		18- 8
Company, 1000 lbs.	9 MV	(Ironclad)	22- 8
Company, 2000 lbs., No. 141	15 GVS		24- 8
Company, 2000 lbs., No. 158	17 GVX		24- 8
Company, 2000 lbs., Nos. 156 and 159	11 MV	(Ironclad)	22- 8
Pikesville Dairy Co., 2000 lbs.	15 GVS		24- 8
Company, Two Ton, No. 140	21 GVS		30-12
Company, Two Ton, 2679 and 2680	21 GVX		30-12
Maryland I. C. Co., Two Ton, 2539 and 2540	21 GVS		30-12
Hendler Creamery Co., Two Ton, 2636	21 GVS		30-12
American Express Co., Two Ton, 20 Wagons	15 MV	(Ironclad)	40-16
Company, 3.5 Tons, No. 144	17 MV	(Ironclad)	45-19
Company, 3.5 Tons, Nos. 152-155	25 GVS		36-15
Gardiner Dairy Co., 3.5 Tons, Nos. 4, 6, 7, 8 and 9	25 GVS		36-15
Gardiner Dairy Co., 3.5 Tons, No. 10	17 MV	(Ironclad)	45-19
American Express Co., 3.5 Tons, Three Wagons	17 MV	(Ironclad)	45-19

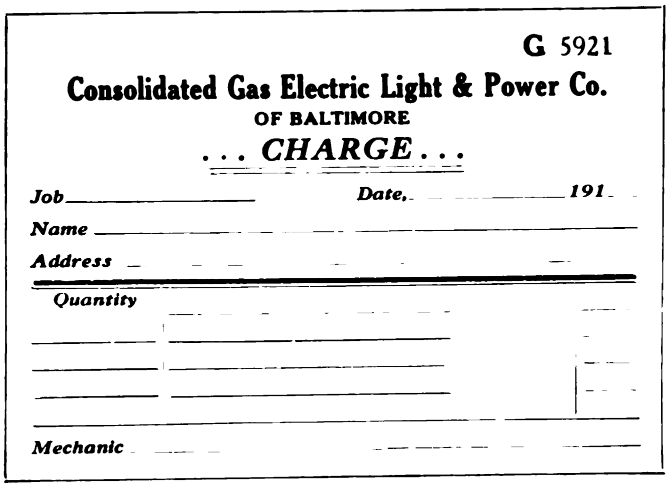
This sheet is signed by the manager of the garage

C. G. E. L. & P. CO. OF BALTO **Daily Charge Report** **Date** **beginning**

Car No. Plug No. V.	A.	Car No. Plug No. V.	A.	Car No. Plug No. V.	A.	Car No. Plug No. V.	A.	Car No. Plug No. V.	A.	Car No. Plug No. V.	A.
12 M											
1 P M											
11											
12 NT											
1 A M											
10											
11											
Gas at end of chg.											
Temp. do											
Gravity do											
Wattmeter-Finish											
" - Start											

Signed __________ Battery Man.

Daily Charging Report, in Black on White Paper, 12 Inches Length and Eight Inches Width, Padded.


G 5921

Consolidated Gas Electric Light & Power Co.

OF BALTIMORE

. . . CHARGE . . .

Job ______ *Date,* ______ *191*__

Name ______

Address ______

Quantity

Mechanic ______

Stock Room Receipt to Accompany Material Requisitioned, in Black on Yellow Paper, 8.5 Inches Length and 6.5 Inches Width.

and approved by the manager of the commercial department. This is not to be varied from under any conditions without the sanction of both garage and department heads. The expectation is to insure a uniform service with reference to the batteries. The methods of the company are thorough and have been carefully developed.

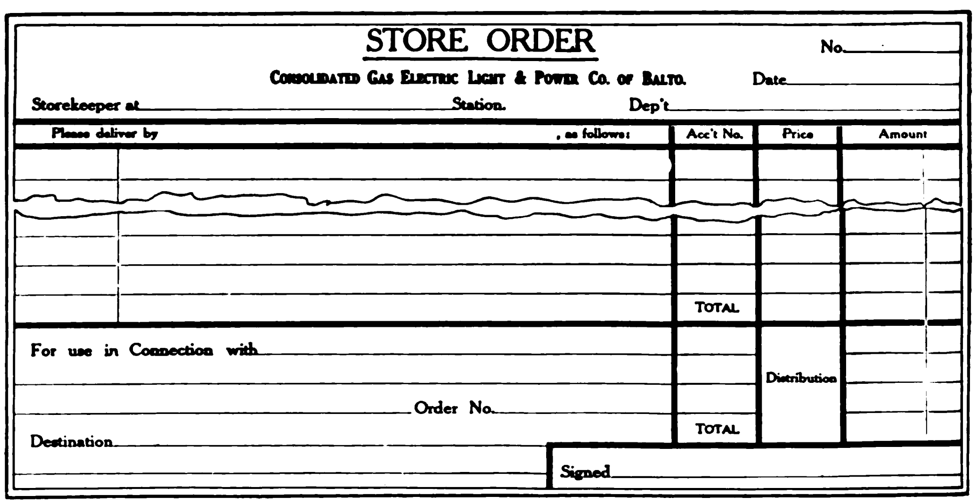
In describing the service of the garage it should be stated that the care and attention do not differ, no matter what the vehicle, although there is of necessity a variance in the character of record, because, in the case of the American Express Company, additional reports are required by that concern. When the contract has been made and the machine is in use each driver is required to make out a report on the "Driver's Report" card, this stating the number of the wagon, the date, the time of leaving and returning to the garage, the odometer reading for the morning and afternoon work, and a brief report on the condition of the machine, this indicating any attention that may, in the judgment of the driver, be required. This is signed and deposited at the garage office. All these cards are examined by the garage foreman, who determines the repairs or adjustments, if any, and from the mileage whatever instruction may be desired with reference to charging.

That there may be no possibility of error all of the orders for repairing, adjusting and special charging instructions are noted on a "Daily Repair and Charging Instruction Sheet" and this is posted in the garage. This gives the number of the wagon, the nature of the repair or the charging direction, and when either or both attentions have been given the initials of the man or men performing the work are entered as an evidence of completion and establishing responsibility. The work required by this sheet is completed and the signature of the night foreman is assurance that the instructions have been followed.

When the machine is driven in from the day's work the driver makes out his report. The vehicle is then placed on the washstand, which will accommodate three, and when washed it is sent to the space assigned to it and charging is begun. Meantime the driver's report has been examined and the daily instructions made out. The work required is performed systematically, and in addition the battery is "watered" and the oil and grease cups filled. Incidentally the vehicles are examined while being worked on by the washers, oilers and battery men, and should there be occasion a report is made to the garage foreman or the night mechanic. The machines are always looked over in a general way if work is being done upon them, and regularly an inspection is made to determine their condition. It will be seen that there is little probability of any defect or condition that might cause damage or failure escaping attention.

If machine work of a character that cannot be performed in the garage is necessary every endeavor is made to make the vehicle serviceable until this can be done. A considerable stock of parts and material is carried and from this practically everything that is needed may be requisitioned. In the event of a battery or motor requiring work that cannot be completed in a night a substitution is made when the vehicle is under contract guaranteed attention, or for the accommodation of a regular customer, so that there need be no delay in service that can possibly be avoided. The company's machines are all worked days, as are the vehicles of other customers, save the American Express Company, which uses one or two nights and some a part of the night, so that the greater part of the work is done between 6 in the evening and 7 in the morning, and Sundays. The busiest day of the week is Sunday, for the inactivity of the wagons affords opportunity for going over them and making examinations and changes of equipment that time might not allow at night or on working days.

A 3.5-ton G. V. truck has been fitted as an emergency machine and this is equipped with a winch,


STORE ORDER No.______

CONSOLIDATED GAS ELECTRIC LIGHT & POWER CO. OF BALTO. Date______

Storekeeper at ______ Station. Dep't ______

Please deliver by ______ , as follows:	Acc't No.	Price	Amount
	TOTAL		
For use in Connection with ______		Distribution	
______ Order No. ______			
Destination ______	TOTAL		

Signed ______

Store Order, in Black on White Paper, Five Inches Length and Eight Inches Width, Padded.

STORE CREDIT RETURNED / RECOVERED MATERIAL

No. ____

Order No. ____

Consolidated Gas Electric Light and Power Co. of Baltimore

Date ____ 191__

Storekeeper ____ Station ____ Sent from Dep't ____

PLEASE CREDIT THIS ACCOUNT WITH THE FOLLOWING MATERIAL		CREDIT ACC'T NO	PRICE	AMOUNT

Returned from ____

Remarks ____

Signed ____

Store Credit, in Red on Yellow Paper, Five Inches Length and Eight Inches Width, Padded.

tools, tackle and whatever experience has taught may be needed, and this is used by the company for its own work as well as for bringing in machines that may have become disabled. This truck is to be equipped with a crane so that labor may be minimized and it will be possible to handle wheels, batteries, motors and other heavy parts should there be occasion to make changes outside of the garage.

The "Daily Charge Report" is made up so that a single sheet may be made to cover the service for six vehicles for a single day, or for one vehicle for six days, and note is made of 24 successive hours from noon, so that the report may be made at any time with reference to voltmeter and ammeter readings, and for a specified vehicle from a stated charging plug. This report shows the condition of the battery at the completion of the charge with relation to gas, temperature and specific gravity, and the wattmeter readings at start and finish. This report is signed by the battery man and submitted to the office. The daily report is sent to the customer and the information is noted in a monthly report compiled for the use of the garage office. When a work outside of the contract requirements is received a "Repair Tag" is made out and on this is noted the size, location and number of the wagon, and the number of the requisition that is made for the part or material used. This tag is attached to the vehicle and the claim check made a part of the tag is detached and given the owner or driver, the check merely serving to identify the wagon through the number of it corresponding with the numerals on the main part of the tag. This tag is used as well for repair work on batteries, etc., and it is utilized as a means of identification between the office and the shop.

In the event of supplies of any character being required by the garage that may be obtained through the company a "Store Order" is made out and submitted to the storekeeper at any specific locality and this becomes a requisition and a voucher for a charge against the garage department. This is a form that is used throughout the accounting system of the company. As filled out a statement is given of the use to be made of the material or supply and the order it is to be used with and the account to which the charge is to be made, where it is to be delivered and the signature of the authority for the order.

The memorandum of a requisition made upon the stock room of the garage gives a serial number, the date, the job number, the name and the address of the person for whom the work is being performed, and besides specifying the quantity itemizes the material. A carbon copy is made that is retained in the stock room, and the original is sent to the office. A "Store Credit" is filled in when material is returned unused or is recovered in a condition to be utilized, and this specifies the material, the quantity and the price, as well as the account to which credit is given. This is another uniform blank of the company.

What is known as a "Store Stock Ledger" is kept in card index form, this being utilized to maintain an

Form A 35—25M—1-26-12

Catalogue No. ____ *Mfrs. Name* ____

Date ____ *Req'n* ____ *Quantity* ____

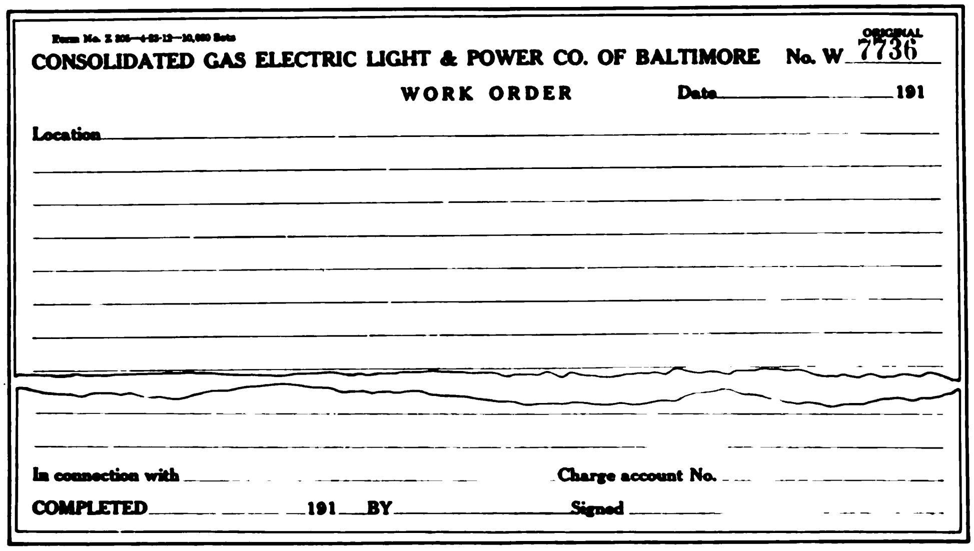
Date ____ *Req'n* ____ *Quantity* ____

Freight, Express ____

Price Per Piece ____ *Price Per* ____ *Sec.* ____ *Bin.* ____ *Max.* ____ *Min.* ____

Req'n	Received	Date	Issued	Balance	Req'n	Received	Date	Issued	Balance	Req'n	Received	Date	Issued	Balance

Stock Room Ledger, a Card Five Inches Length and Eight Inches Width, Printed in Black on White, Both Sides, Kept in Files.


Form No. Z 205—4-23-12—10,000 Sets
CONSOLIDATED GAS ELECTRIC LIGHT & POWER CO. OF BALTIMORE No. W 7736 ORIGINAL
WORK ORDER Date ______ 191
Location ______
In connection with ______ Charge account No. ______
COMPLETED ______ 191 __ BY ______ Signed ______

Work Order, Five Inches Length and Eight Inches Width, in Black on White and Pink Sheets, the Former Being the Original and the Latter the Copy, and Differentiated by "Original" and "Duplicate" Above the Serial Number.

The time report also deals with the time of the workmen on repair work of any character, as well as serving as a record for the other departments of the company, this covering the service of the wagons. This gives the name of the department to which the pay roll is to be charged, the rate of pay of the man and wagon, the name of the check number, wagon number, the order number, the location and description of the work, the account, the time of starting and completing the work, the number of hours and the charge for labor and vehicles separately itemized and totalled. The record is attested as correct and is approved, with remarks if the occasion justifies.

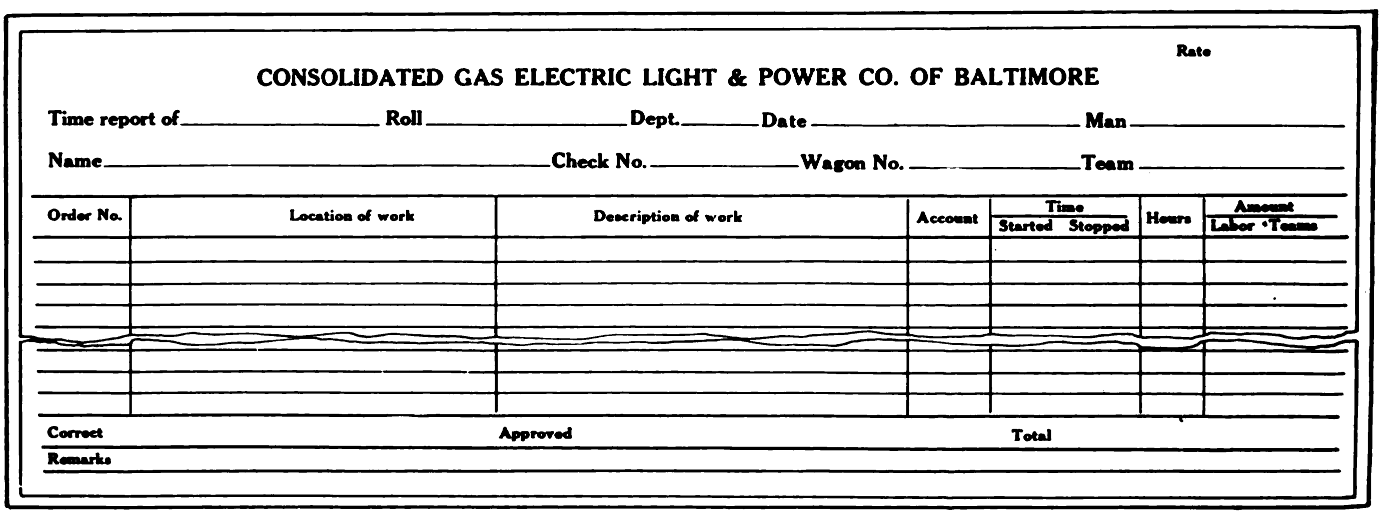
inventory as well as a statement of stock received. This gives the catalogue number, the name of the manufacturer, the name, the date, the requisition number, the quantity, the price separately and in stated quantity, the section of the stock room, the bin number and the maximum and the minimum quantity permitted. The entries are of the requisition number, by whom received, the date, the number issued and the balance remaining in stock. The card will permit of 120 entries.

In connection with the work performed for the company a "Work Order" is issued, the order being in duplicate and bearing a serial number. This order is utilized for work performed in the garage as well as by the vehicles or for labor in other departments. This gives the date, the location of the work, its connection if any with other work, and the number of the account to which it is to be charged. This is indorsed with the date of completion, the name of the person performing the work, and is signed by the person having supervision, in the case of the garage this being the manager or the foreman. The original is filed with the record of the job and the copy is sent to the office, this being the data for accounting.

The "Receiving Sheet" that records the receipt of material for the garage is another of the general forms utilized for the garage, and this shows the quantity and the material, the requisition number, the date, from whom received, the name of the receiving clerk, by whom the stock was entered and remarks. This is made in duplicate and the original is kept on file and the copy is sent to the office. Requisitions are made upon the purchasing department on a standard form, these being in duplicate, the copies being retained in the office.

A form of individual battery record is now in preparation, which will show the exact work performed with each battery, the number of charges, the number of discharges, the mileage, the dates of examination and work, the dates of equalization, the condition at differing dates, and the cost of labor and material. This is expected to give exact data of each battery and the cost for each mile of service.

The "Tire Record" is kept in card index form, the tires being classified as to size, the cards showing the number of the wagons on which these sizes are used.


Rate
CONSOLIDATED GAS ELECTRIC LIGHT & POWER CO. OF BALTIMORE
Time report of ______ Roll ______ Dept. ______ Date ______ Man ______
Name ______ Check No. ______ Wagon No. ______ Team ______

Order No.	Location of work	Description of work	Account	Time Started	Time Stopped	Hours	Amount Labor	Amount Teams

Correct Approved Total
Remarks

Time Report, Six Inches Length and Nine Inches Width, in Black on Pink Paper, Printed Both Sides and Padded.

Consolidated Gas Electric Light and Power Company of Baltimore

MATERIAL received at ________ *STOREROOM*

Req'n No. ________ *Date* ________ 191__

RECEIVED of ________

Bags	*Carboys*		
Barrels	*Coils*		
Boxes	*Crates*		
Bundles	*Reels*	*VIA* ________	*CHARGES* ________
WEIGHT	CAR INITIAL and No.		WAY-BILL

QUANTITY	MATERIAL

REMARKS

Receiving Clerk ________

Entered by ________

Receiving Sheet, 8.6 Inches Length and Width, in Black on Alternate White and Yellow Sheets, to Be Entered in Duplicate, and Perforated for Loose Leaf Binding.

The data include the make, the date received, the position on the vehicle, the date placed on the wheel, the date removed, the mileage, the number of day's service and remarks.

Monthly reports of the garage are divided to cover vehicles used by the electric department of the company, by the gas department of the company, and by customers of the garage, which is made up to include in parallel columns the number of the vehicle assigned by the company or the customer, the number of the maker of the vehicles for which the garage is agent, the vehicle capacity, the department using the vehicles, the period of service between stated dates, the number of hours in service, the total number of miles, the current as represented by kilowatt-hours, and remarks relative to the machines worthy to note. The footings of the hours of service, miles and kilowatt-hours are given, which represent the entire work, miles traversed and current consumed by the machines stored and maintained at the garage. A glance at the form will show its usefulness. This report is compiled from the daily records and is submitted to the office for the purpose of giving briefly the work accomplished by each vehicle. The possibilities for comparison are especially beneficial.

The occurrence sheet is a report made by a driver of any happening in which he or his vehicle, or both, are involved, which has to do with damage or injury to person or property, and it may be summarized as a letter of record, which is taken as the basis for inquiry or investigation in the event of either being necessary. These sheets are submitted by the garage manager to the manager of the commercial department. They are kept in the file form for reference.

The "Chamber of Horrors" is unique in that it is a large board or tablet on which are permanently displayed such parts of machines as may have been damaged or have failed through neglect, carelessness, incompetency or any other cause within the control of the driver or garage men, and with each is a card describing the cause and how the employees might have prevented the damage and loss of time and expense. It is the belief of the management that this exhibition has a decided value and serves a distinct purpose, as it demonstrates the consequences that may be prevented by the exercise of common sense, and indicates the responsibilities of the man as established by the company.

Another interesting means of educating the drivers is the "paving map" of Baltimore, which is a map showing the streets of the city and indicating which are paved, so that it is possible for the drivers for the company and for customers to select the route that should be best to economize time and minimize wear on the vehicles. This map is carefully revised and kept up to date. It is possible through its use to avoid poor paving and streets on which the surfaces have deteriorated, and to choose the highways where the paving is at the Baltimore standard or the surfaces are good. This has been found especially useful in haulage in sections not familiar to the men.

The insurance record is a standard form used by the company with reference to insuring all its property, and this is an application to the treasurer of the company to secure protection on the garage and its equipment or the vehicles, and when filled it provides the description necessary for the application for the insurance and for incorporation in the policy.

In the garage office are kept the records which are sent to the accounting department of the company, and these are supplied daily or monthly as may be required. The garage itself is known to the auditor

REPORT OF ELECTRIC GARAGE

30 South Eutaw Street

Month of December, 1912

CAR NO.	G V No.	Capacity	Used by	Dates	Hours in Service	Miles	KWH	Remarks.
Vehicles Used by Gas Department								
Vehicles Used by Customers								
Total Hours in Service								
Miles								
KWH								

American Express Company's Numbers Are Numbers Assigned by That Company

Approved ________ Signed ________

Monthly Summary of Current Consumption and Mileage for Each Wagon, on Sheet 10.5 Inches Width and 12 Inches Length.

as the subject of "Account No. 300," and in accounting this deals with the operation of the agency for vehicles and the operation of the electric garage. The explanation of the account is as follows:

This account is intended to show the cost of operating the electric garage, 30 South Eutaw street, and the electric vehicles owned and maintained by the company, also to show the income derived from the operation of the garage and vehicles and sale of vehicles and should be sub-divided as follows:

(A) Garage Expense—To be charged with all labor, material, electric current and other expenses of operating and maintaining the electric garage at 30 South Eutaw street, and the charging station at Monument street, storeroom or elsewhere, including the rental of the garage building at 30 South Eutaw street, excluding the maintenance, repairs or depreciation of vehicles.

(B) Vehicle Expense—To be charged with all labor, material and expense for maintenance and repairs of the electric vehicles in connection with work done at the garage at 30 South Eutaw street, including replacement of tires or other parts of vehicles.

Tire Record **Size 3** **Wagon No.**

Make	Date Reset	Pos. on Veh.	Date on Veh.	Date off Veh.	Mileage	No. Days Service	Remarks

Tire Record, Three Inches Length and Five Inches Width, on Card Perforated for Filing.

(C) Vehicle Fixed Charges—To be charged with allowance for interest, depreciation and insurance on electric vehicles owned and operated by the company.

(D) Selling Expense—To be charged with any soliciting or selling expenses in connection with the sale of electric vehicles, including the pay of the drivers for demonstrating purposes and including the per diem charged for any vehicles used for selling or demonstrating purposes.

(E) Garage Income—To be credited with the amount of all charges made to customers, including this company, for care of battery and vehicle storage, washing, oiling and inspection, according to schedule of rates fixed for such service, to be found in the company's selling programme.

(F) Garage Repair Income—To be credited with the amount of all charges made to customers, including this company, for maintenance and repairs of electric vehicles, including replacement of tires and other parts of vehicles to be covered by repair and maintenance charges issued by the garage.

(G) Vehicle Rent—To be credited with the balance remaining in the per diem against departments for the use of electric vehicles after crediting Garage Income and Garage Repair Income, thus balancing sub-accounts (A), (B) and (C).

(H) Income from Sales—Will be credited with any profit made on the sale of electric vehicles.

It is further explained: That it is understood that all electric vehicles owned by the company are to be subject to a per diem charge representing the full cost of the vehicles which will be made up of an allowance for interest, depreciation, insurance, the charge for garage service, storage, washing, oiling and inspection according to the company's schedule for such charges, and the charge for electric current according to the company's schedule of charges. This per diem, together with the cost of maintenance and repairs, as such cost may accrue, is to be charged against the department for such days as the vehicles may be used. The cost of drivers for vehicles is not handled through this account. This is an operating account under the heading of "General Expense, Electric."

In making up the per diem charge it was found that the cost of operating the vehicles did not greatly vary, and after a considerable experience in determining a price that might be applied to each type of vehicle it was decided that it would be best to make a uniform charge of 35 cents an hour for machines up to and including 2000 pounds capacity, and 70 cents an hour for machines of more than 2000 pounds capacity, and these prices are now charged against the departments.

BIG ORDER FOR G. V. MACHINES.

American Express Company Buys 25 Two-Ton Wagons and Three Money Carriers.

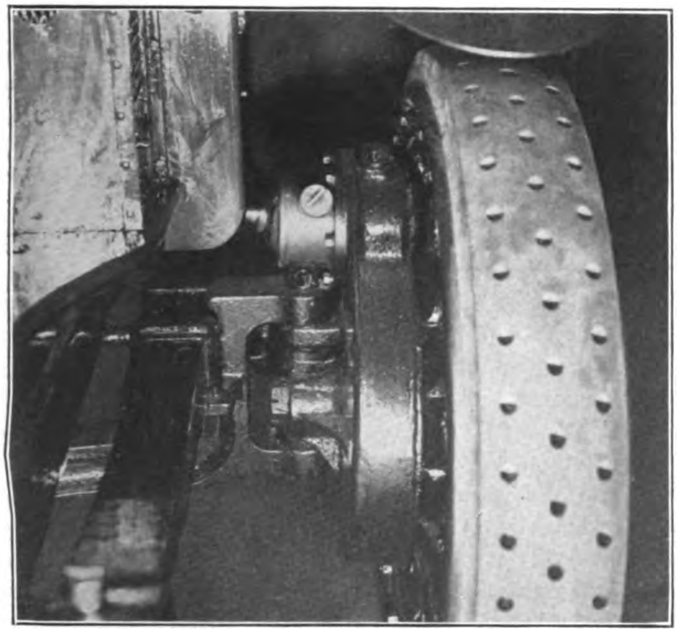
The American Express Company has placed an order for 25 two-ton and three money wagons with the General Vehicle Company, Long Island City, N. Y., and delivery will be begun in March. Of these the 25 machines will be fitted with standard express type covered bodies and they will be the initial installation at Boston, Mass., while the others will be used in New York. The company has electric machines in service elsewhere in the country, but the translation of the Boston delivery equipment was not determined until after exhaustive observation of differing forms of conveyance and accurate data had been compiled, all with reference to climatic, traffic and other conditions, and to establish what would be the most dependable and economical form of distribution and haulage in that city.

In this determination the company had the benefit of its excellent system of accounting of horse delivery expense and the scientific observing of two makes of electric and three makes of gasoline vehicles. The recommendation for the Boston service was from the showing for adaptability, reliability and economy. It is expected that the machines will be delivered at the rate of 10 a week, and that with the change the service will be improved.

WALTER TO BUILD UNDER LATIL PATENTS.

Front Wheel Driven Machines, Used for Nine Years in France, to Be Manufactured in New York---Details of Design and Construction.

SIMULTANEOUS with the exhibition of the Walter-Latil service wagons at Madison Square Garden was the announcement that the Walter Motor Truck Company, New York City, had acquired the



The Front Wheel Drive of the Walter-Latil Truck, a Construction for Which the American Manufacturing Rights Have Been Secured by the Walter Motor Truck Company.

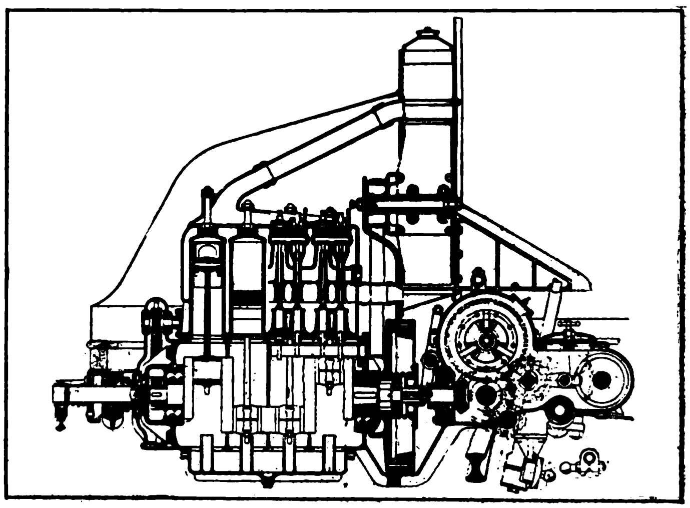
American right to manufacture under the patents issued by France to Latil Freres, and that it was purposed to build there vehicles in sizes from one to five tons. The Latil is a front wheel driven automobile in which the power is transmitted from the engine through a bevel gear to a cross or counter-shaft carrying spur pinions at the outer ends, which engage with spur gears fixed to the front wheels. The first Latil was produced nine years ago and it has been long recognized as one of the standard machines of Europe, and following the investigation by the engineers of the Walter company and the acquisition of the American right, similar rights were acquired by other concerns, these including England and several other European nations.

The Latil construction is primarily a chassis carried on two wheels, which may be coupled to any form of rear equipment, and from which it may be conveniently detached, or it may include an entire vehicle. That shown at New York was a service wagon with the chassis mounted on four wheels. The front or traction wheels are shod with rubber tires, but the rear wheels may have either rubber or steel shoes. As utilized in Europe the steel rear tires are generally the equipment, but rubber is used when the machines carry passengers or fragile freight. The two-wheel chassis has been found very practical for changing the body equipment, and in some instances the attachment is so made that the chassis coupling will permit dropping the rear end of the body and raising the forward end and supporting it rigidly inclined for loading or unloading. It is entirely practical to convert horse equipment for use with the chassis.

The claims are made that with about 80 per cent. of the load taken on the rear wheels, and with practically a constant load carried on the front wheels, the machine has unusually easy riding qualities; that the front wheel drive minimizes skidding; that brakes may be used on both front and rear wheels independently or in combination on all four wheels; that with the chassis construction the entire mechanism is accessible at all times, no matter whether or not the vehicle is loaded and that driving is easy through the rotary movement of the front wheels. It is also maintained that a smaller engine will afford a satisfactory speed and hill climbing capacity. Two types of chassis are built in France, the one for vehicles with capacity ranging from one to three tons and the other for capacities of four and five tons. With either the power transmission is identical, but the other details of construction differ.

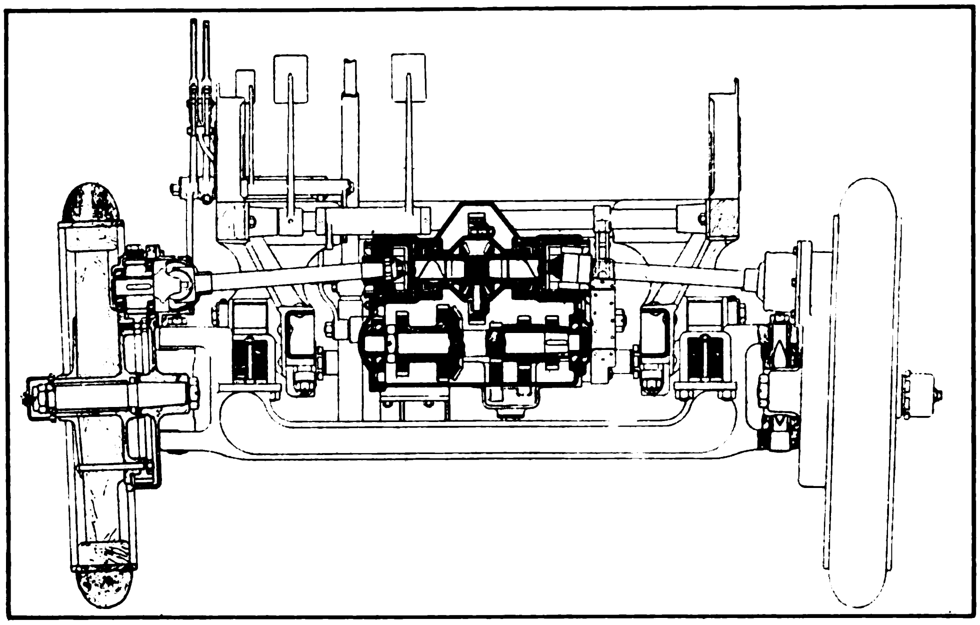
The smaller vehicles are equipped with a four-cylinder engine, rated at 18 horsepower. The cylinders are cast en bloc with bore of 85 mm and stroke of 140 mm, corresponding to 3.35 and 5.5 inches, respectively. The valves are all arranged on one side and the camshaft is chain driven and is provided with a jockey pulley adjustment.

Lubrication is by a combination of the pump and splash systems, the pump taking oil from a sump in



Longitudinal Section of the Power Transmission System of the Walter-Latil Small Type of Chassis.

the crankcase to a reservoir on the dash, whence it is forced through separate leads to troughs cast in the lower portion of the crankcase into which the big ends dip. Ignition is by Bosch high-tension magneto. Cool-



Transverse Section of the Power Transmission System of the Walter-Latil Small Type of Chassis.

ing is by thermo-syphon, the radiator being mounted in front of the dash. In addition a fan is carried on a shaft fitted with ball bearings and driven by means of a belt from a pulley cast on the front of the flywheel.

In order to make the engine as compact as possible, the crankshaft has no centre bearing, but double ball bearings of ample size are housed at each end of the crankcase and carry the crankshaft. The camshaft also runs on ball bearings.

The change speed gearing and differential are enclosed in one case bolted to the rear of the crankcase, the use of a long clutch shaft and universal joints being eliminated. In this case the leather faced cone clutch slides on a short shaft, which drives the main gearshaft by means of bevel gearing. The main shaft and the layshaft run at right angles to the motor.

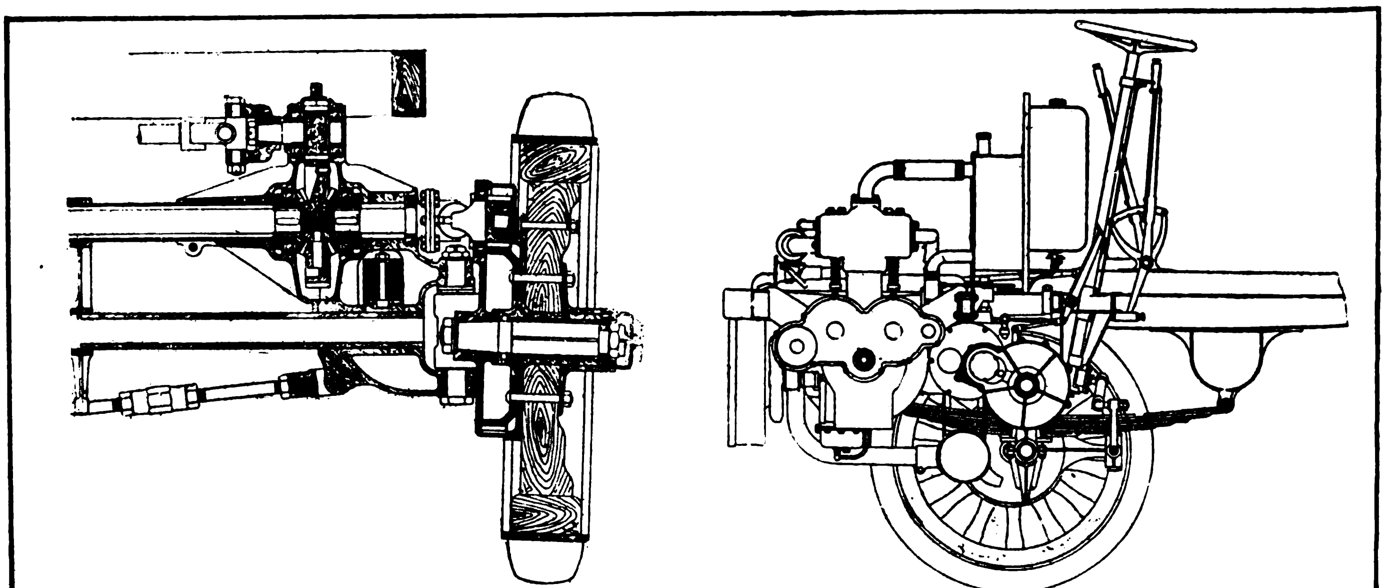
Four forward speeds and reverse are provided, the high speed being direct to the differential. The speed changes are effected by means of a lever operating in a "tramway," and the drive to the differential is by spur gearing. Both gearshafts run on ball bearings and felt oil retainers are provided wherever necessary.

The drive from the differential to the road wheels is taken through two cardan shafts, each fitted with two universal joints. The joints at the ends of the shafts nearest the wheels are of the ball and socket type, and are enclosed in grease cases. The angle of these two shafts is not great, a feature which is held to make for little loss of power in friction at the joints.

In order to allow for variations in the angle of the cardan shafts, the joints nearest the differential gear are made so as to permit considerable end travel. As a precaution against the forks coming out of mesh with the ball joints, springs are inserted between the ends of the shafts and the universal joint boxes.

The ball bearings of the pinions which drive the gears attached to the two front wheels are housed in castings, which also carry stub axles and the arms to which the steering rods are atached. These castings, which serve in some measure as dust covers to the pinions and gears, swivel between the jaws of the main portion of the front axle.

The engine and gears are suspended from three points. Two arms extending downward from the two main longitudinal members are secured to the gearbox, and a bracket attached to the front cross member and terminating in a socket, into which fits a ball



Constructional Detail of the Walter-Latil Large Type of Chassis: At Left, Transverse Section Showing the Differential and the Driving Gearing; at Right, a Longitudinal View of the Power Plant Assembly.

secured to the front of the crankcase, carries the motor.

The steering gear is of the usual worm and segment type. The foot brake acts upon a drum carried on an extension of the speed gearshaft and takes effect upon the front wheels. A side lever operates two band brakes on the rear wheels. In the event of steel tires being utilized on the latter the brakes are arranged to act upon the rims.

The larger type of chassis is fitted with motors of 27 or 30 horsepower. The four cylinders are cast in pairs, and have bore of 105 or 110 mm and stroke of 140. The valves are arranged on both sides of the motor and are interchangeable. Their lift may be regulated by adjustable tappets. Both camshafts are chain drive and are provided with the same form of adjustment as that of the smaller machine.

Ignition and lubrication are the same, but the cooling system is different. Circulation is maintained by a gear driven pump, the discharge from the cylinders passing into a tank on the front of the dash, whence it finds its way to the tubular radiator suspended at the front of the chassis frame, and so back into the cylinders. The fan is carried on a bracket secured to the side of the crankcase, and is belt driven from a pulley rotated by one of the camshafts.

The leather faced cone clutch is carried in the flywheel in the usual manner, and on the clutch shaft is a spur gear which is in constant mesh with a pinion on the gearshaft in the gearbox, the last named being at the rear of the motor. The differential gears are in a separate case, bolted to a casting secured to the front axle. Drive to the differential is transmitted by a small shaft and universal joint to a spur wheel in constant mesh with the crown wheel of the differential.

Owing to the arrangement of the mechanism, the whole of the transmission gearing is located at one side of the chassis frame, necessitating the use of cardan shafts of unequal length. However, these shafts work in a horizontal position instead of at an angle, rendering the use of ball and socket grease casings over the universal joints unnecessary, and no universal joints are required at the differential ends.

Additional details are presented in accompanying sketches, those brought out herein being the leading features. The chassis frames in the lighter vehicles are of pressed steel, while in the larger rolled channel steel strengthened with wood is used. The speeds vary from 12 to 18 miles an hour, according to the carrying capacity.

Included among the orders recently received by the Atlantic Vehicle Company, New York, N. Y., and Newark, N. J., maker of Atlantic electric wagons and trucks, were those for six five-ton trucks for the Ebling Brewing Company, one five-ton truck for the Wall Rope Works, two five-ton trucks for the Kips Bay Brewing & Malting Company, and a one-ton wagon for A. Silz, Inc., all located in New York. These machines are now under construction.

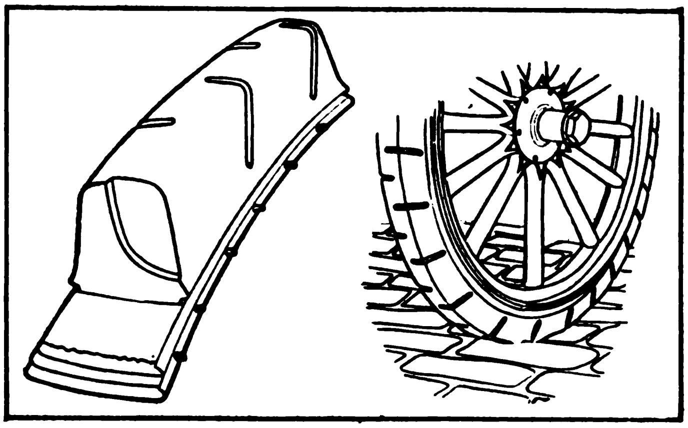
SWINEHART HEADS NEW COMPANY.

Will Direct Manufacture of Tires by New Processes for All Forms of Vehicles.

The St. Louis Tire & Rubber Co., University City, St. Louis, Mo., has been organized with J. A. Swinehart as vice president and manager, and has begun the manufacture of solid and pneumatic tires. Mr. Swinehart retired from the industry three years ago, but was so much impressed with the service given by the St. Louis tire in experiments covering more than two years that he has again entered business.

The accompanying illustration shows a section of the solid type, which is alternately notched at either side at an angle of 20 degrees to the radii, a construction that is claimed will prevent skidding and obviate the use of chains on wet or muddy paving. Cross wires slanting forward and backward are placed in the base to prevent creeping of the tire when the wheel is driven in either direction. It will fit any clincher rim, whether detachable or single section.

It is claimed for this tire that it is very resilient,



Sketches Showing the New Notched St. Louis Solid Tire That Is Claimed Will Not Skid.

will require less current than a solid shoe when used on electric vehicles, that the notches give certain traction and clean a path for the tire where the road is wet or muddy. It is held that a rough surface on a smooth paving will not make as good a contact as a perfectly smooth surface on a clean pavement.

The company manufactures as well a truck tire of the flange type, and a pneumatic shoe made under a new principle. The carcass is expanded within the mold by hydraulic pressure, which insures against buckling and pinching of the fabric, and equally distributes the strain on all the layers of fabric.

The Electric Storage Battery Company of Philadelphia has issued invitations to a dinner to be tendered to the electric vehicle manufacturers and the distributors of Exide batteries at the Mid Day Club, 68 West Munroe street, Chicago, Ill., the evening of Feb. 5 at 7. This will be one of the features of the entertainment during the pleasure car show in the Windy City, and it will be especially attractive because of the unusually excellent speakers who will attend.

PEERLESS PLANS FOR EXPANSION.

Increase of Capital and Acquisition of New Stockholders Make for Advancement of Truck Line.

Successful in producing and marketing Peerless pleasure cars and trucks under a moderate capitalization, the Peerless Motor Car Company, Cleveland, O., is planning to do business on a larger scale during 1913. Its authorized capital has been increased from $3,000,000 to $10,000,000 and several new stockholders of wealth and influence have entered the company. While the pleasure car will in no wise be neglected, it is understood that much more energy and capital than heretofore will be applied to the advancement of the commercial vehicle line.

The Peerless company has decided to pay a dividend of 40 per cent. to its shareholders, payable from the surplus of the common stock. The stockholders also have been offered the right to exchange one-half of their holdings for an equal amount of preferred stock. A majority has announced its intention to make the exchange. The increase in capital is designed to carry out the development plans of the officers who have subscribed so liberally to the new stock and of the new interests working in complete harmony.

The new stockholders have been successful in kindred fields and the Peerless company will gain much in 1913 by their determination to take personal interest as members of the board of directors. These men are: E. S. Terry, H. A. Tremaine, B. G. Tremaine, J. B. Crouse and J. Robert Crouse. The new year was started by the Peerless company with a paid-in capital of $4,300.000 and assets, after deducting all liabilities of every kind, of between $5,000,000 and $6,000,000, exclusive of patents, trade marks and good will.

TO BECOME CONSULTING EXPERT.

C. T. Myers Leaves General Motors Truck Company to Engage in New Line of Endeavor.

Cornelius T. Myers, who for the past two years has been mechanical engineer and chief engineer of the General Motors Truck Company, Detroit, maker of G. M. C. trucks, has severed his connection with the company. He is returning to the consulting work which he dropped to assist President Neal in caring for some of the engineering problems then confronting the General Motors Truck Company.

When Mr. Myers completes some special work which he has on hand he will be in a position to carry on a consulting engineering practise in all lines of automobile activity, but particularly in the commercial vehicle field. Among other things he will make a specialty of reports to prospective purchasers on their local conditions with respect to motor transportation, and on the particulars of the various machines on the market. His office is at present located at 49 Pingree street, Detroit.

TAKES OVER INVADER OIL.

New Concern Organized to Produce Lubricant Made Prominent by Chas. F. Kellom & Co.

The firm of Chas. F. Kellom & Co., Philadelphia, Penn., maker of Invader oil, has been acquired by a new corporation to be known as the Invader Oil Company. T. E. Tomlinson, a pioneer in the study of special oils for automobile use, will be vice president and general manager of the new concern. Charles F. Kellom will remain as president and the Kellom manufacturing and selling organization will remain intact. H. Dunthorn will be secretary and treasurer of the company, which has been incorporated under the laws of New Jersey with an authorized capital of $250,000. The factory will remain at 113 Arch street, Philadelphia, and the general offices will be located at 80 Broad street, New York City.

The sales staff of the Kellom company, which includes D. A. Scheu, who for many years covered the New England territory, will be retained, and in addition Mr. Tomlinson will have associated with him a number of the better known men who were identified with him in previous ventures. Among them are: H. Dunthorn, J. T. Rose, A. A. Francesconi, Howard Plowman, Harvey Wilkins, E. Kalkhof, F. Menke and A. Rafelson. Mr. Kellom began the oil business in 1881 and claims to be the first to introduce light oil for use in automobiles. Mr. Tomlinson first engaged in the business several years ago and created the famous Havoline oil, which attained national prominence. He later organized the Wolverine company, which he built to large proportions.

RESIGNS FROM REO COMPANY.

Charles E. Easton Joins Advertising Agency Headed by Gleeson Murphy, a Former G. M. C. Man.

Charles E. Easton, formerly sales manager of the Reo Motor Truck Company, Lansing, Mich., has resigned his position to join the Detroit staff of the H. K. McCann Company, an advertising agency, of which Gleeson Murphy, formerly with the General Motors Company, is the head. Mr. Easton has acted as advertising director of the Reo concern for the past two years and joins the McCann company well equipped for his new work.

Before joining the Reo company Mr. Easton had charge of the advertising departments of the Buffalo Forge Company and the E. R. Thomas Automobile Company, both of Buffalo, N. Y. He also handled the advertising department of the Inter-State Automobile Company, Muncie, Ind. He is a graduate engineer who has made a study of advertising along several different lines of business. He has planned and handled both mechanical and sales management in his various connections in the automobile and accessory industries during the past eight years.

ELECTRIC-GASOLINE SERVICE STATION.

Combination Garage of the Empire State General Vehicle Company, Rochester, N. Y., That Sells and Garages Pleasure and Industrial Machines and Has Facilities for Care and Maintenance Distinctly Promotive of Their Use.

By William W. Scott.

THE service afforded by the public station of the Empire State General Vehicle Company, 15 Circle street, Rochester, N. Y., is an example of the possibilities of the combination garage that is probably unequalled in America, and the policy of the company has established it as one of the most progressive in the country. This statement is made with a knowledge of some admirable installations, but not one of these has worked out service to meet the requirements of so many differing systems of delivery. To illustrate, this company is the agent for electric and gasoline service wagons and pleasure vehicles as well as industrial trucks for manufacturing plants, and it has the usual gasoline machine garage where every attention is possible, but in addition it will undertake the garaging and maintenance of electric service wagons at stated prices a day, and it has perfected a system that will be inaugurated March 1 in all probability, so that it will rent batteries on a mileage basis, and the customer can have what may be regarded as a constant battery service when in need of more than the usual capacity of his equipment.

Combination Electric and Gasoline Garage of the Empire State General Vehicle Company, 15 Circle Street, Rochester, N. Y.

This mileage rental of batteries will be similar to the system inaugurated by the Hartford Electric Light Company, Hartford, Conn., but there is only one other concern in the country that has undertaken the maintenance contract of electric machines, and this with a single firm's equipment, so it can be stated that the Empire State company is the pioneer in this form of service. The garage now used is located about a mile and a half from the centre of the city, which has been an unfavorable condition so far as encouraging patronage is concerned, and it is not improbable that within a comparatively short time a new location will be obtained which will be much more convenient to the business district.

The Rochester Railway & Light Company was one of the first concerns in Rochester to use electric vehicles and it established a garage in which to store and maintain its machines. There had been several agents for electric service wagons in Rochester, and a number of purchasers had failed to realize the results expected, largely through the lack of facilities for upkeep and ignorance of the attention that should have been systematically given.

The Empire State General Vehicle Company was organized after a very careful investigation of the possibilities of highway haulage by mechanical vehicle, and the conclusion had been reached that to develop the enterprise to a large measure of productiveness it was necessary to have equipment and facilities to meet every requirement of the people. By this is meant that it was not only necessary to have the agency of several standard makes of vehicles and the garage for storing them, but it was desirable to efficiently maintain them and to afford options of form of maintenance to insure to the owners a constant and unfailing service.

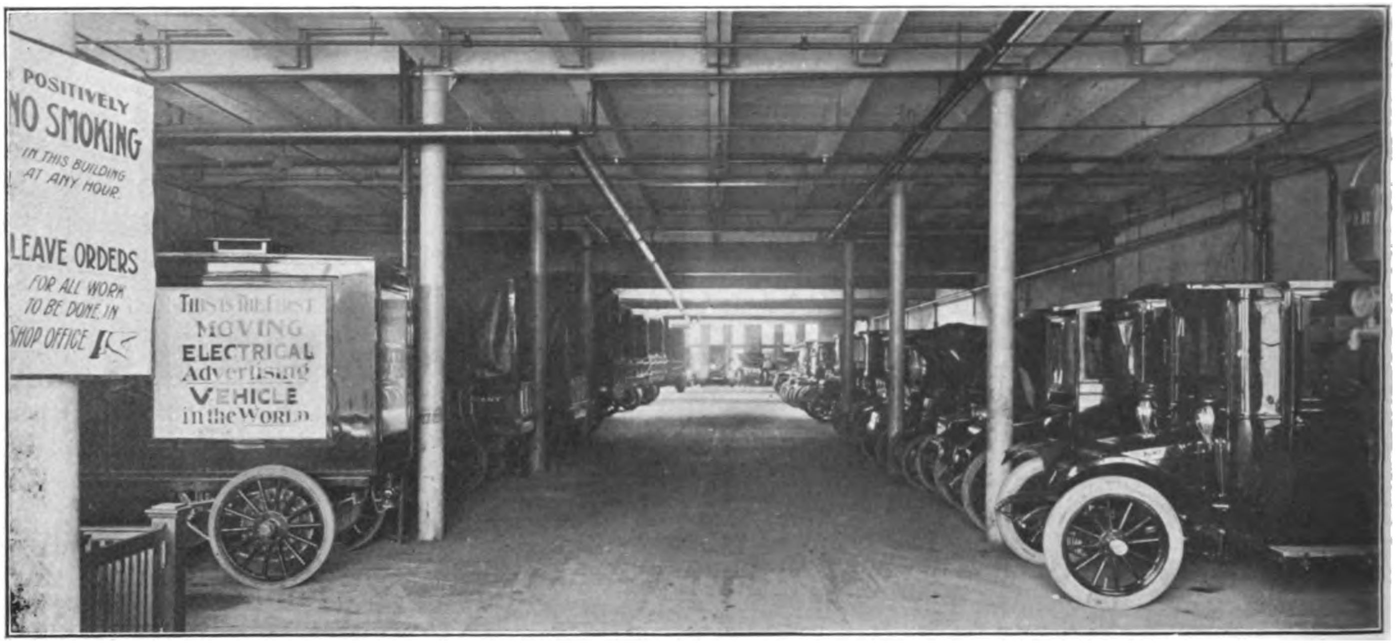
As a business proposition it was believed that it would be best to deal with both electric and gasoline machines, and to be able to supply any demand for transportation that might eventuate. When the company was formed the first agency secured was that of the General Vehicle electric wagons, and to provide garaging facilities that would be sufficient and assure customers of a satisfactory attention a contract was

made for the temporary use of the garage of the Railway & Light Company. By this contract the company fortified itself against the difficulties that might be met with in the establishment of an electric service station and insured the co-operation, at least, of the central station in development work.

The attitude of the central station with reference to the owners of electric vehicles is decidedly important, but so far as the company was concerned the policy established was to make possible the greatest economy in the use of all service machines, and to insure this economy to the owner. After the organization had been perfected the company decided to locate its salesrooms and garage at Circle street, in the first building erected on the present site. This was a structure 210 by 50 feet, with a two-story section across the front end, with the remainder a high single story with a saw-tooth roof to afford sufficient light. This building was of brick with stone trimming and was de-

As the garage is now utilized the old or right section as seen from the front is given over to gasoline machines and the repair shop, and the new or left section is the electric garage and charging station. The two divisions are separated by a heavy wall extending the full length, with a large door at the rear through which access is had from the electric garage to the repair shop, and by a door near the front of the building. At the right of the entrance to the electric side is a portion of the office, and at the left a salesroom. The other section houses a part of the office, a waiting room, a stock room, etc. Either side back of the head houses is not obstructed, the roofs being supported by trusses, so that every inch of room may be utilized.

Besides the General Vehicle electric wagons the company secured the agencies for the G. M. C. gasoline wagons, and the Buffalo Electric Vehicle Company's and the Locomobile Company of America's lines of pleasure cars. In addition the Automatic



Interior of the Electric Section of the Garage of the Empire State General Vehicle Company, Showing the Storage Space Available on the Main Floor.

signed with an office and salesrooms in the front, with an entrance between the two into the garage that occupied the greater part of the structure. The equipment included charging panels and the usual electrical installation necessary, machine tools, etc.

The removal to the garage was made in October, 1911, and the following spring the garage was increased by the erection of a second building the same size as the other, but somewhat differently designed. The front is two stories and is full height instead of gabled, and this affords a salesroom on the second floor and facilities for painting and finishing. The roof is lighted by skylights and the rear of each building is well lighted from large mill windows at the rear. The garage now covers about 21,000 square feet of ground, of which about 15,000 is given over to storage space, the remainder being occupied by the office, the salesroom, the repair shop, battery room, elevator and washstands.

Transportation Company's industrial trucks, these being propelled by electric power, were taken on. With this line the organization was developed and extended, there being four distinct divisions of the sales department, which is primarily divided into pleasure vehicle and service or truck sales sections, and each of these is directed by a manager. The salesmen are assigned to the division in which they are best adapted to serve. The garage and repair and maintenance departments are similarly organized and the whole are under the supervision of a general manager, who is vice president of the company.

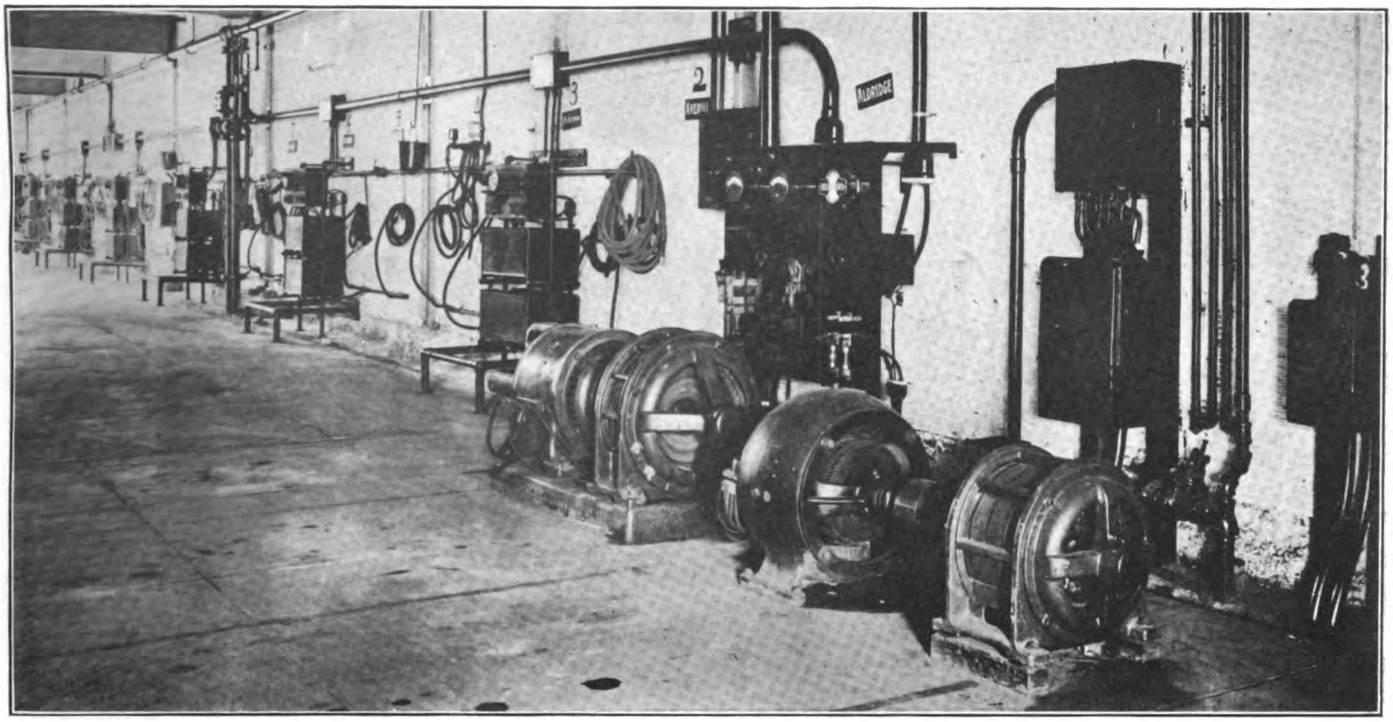
The selling plan is to be able to supply a well known and entirely practical vehicle for whatever service may be required, and to make recommendation of what form of power will, in the judgment of the sales manager, give the best results, or to supply the vehicles which will meet the requirements of the person desiring them. This policy is believed to be what

will reach the largest number of probable buyers, and while it is not practical to have representation of more than one line of machines, the agencies were made with the purpose of selling service wagons of as wide a range of sizes as could be obtained, so that nearly every character of delivery equipment could be supplied. With the different sizes of the electric and gasoline wagons the light and fast vehicles or the heavy and slower machines can be delivered, and with the resources of the companies deliveries can be made within a comparatively short time.

Having established the policy and the organization for the sale of machines it was found that the demands for garaging and maintenance were imperative. The man or firm having an initial installation of one or two gasoline wagons may feel that it is wise to have his own garage, but there are others who believe that it is best to have the service regular and vious that competent men cannot be employed at the same ratio of expense with the smaller number. Yet their services are just as essential.

The establishment of the garage and the sales agencies was with a view of developing a successful business, which might eventually assume large proportions, and it was realized that reputation for service was absolutely necessary. To afford this to the business men of Rochester and vicinity has been the purpose of the company, and while time must necessarily elapse for the concern to receive the recognition that is hoped for, there is no doubt of the soundness of the policy or the character of the results.

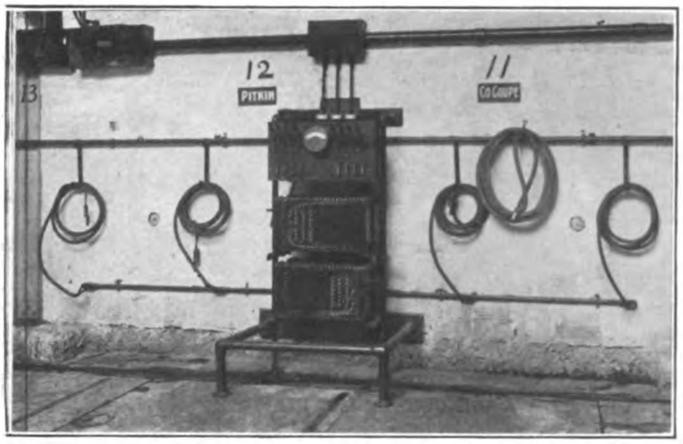
The progressiveness of the company is evidenced by its adoption of several systems of attention which have not been carefully worked out from long experience. With reference to electric vehicles the one is the maintenance of a machine of a given capacity for



Motor Generator Set and Charging Panels Serving Four Machines Each in the Electric Section of the Empire State General Vehicle Company's Garage.

systematic, as afforded by a public station, rather than take the chance of the more uncertain attention that will be given by a driver or drivers, with such assistance as may be employed from time to time. While there are some purchasers of wagons and trucks who are seemingly satisfied with their own knowledge and resources there are others who realize that the real economy of the motor vehicle is in keeping it serviceable at all times, or as near to this condition as is possible. It is this class that demands the high class garage and the best of attention. With electric machines it was found that there was an even more insistent demand for garaging under the supervision of experts, and this can be said to obtain until an installation of considerable proportions has been made, because it will require no more men to properly attend and maintain 40 vehicles than it will 10, and it is ob-

a stated amount daily and another is the battery rental on a mileage basis, while a third is the adoption of the gravity charging method for batteries, and these are regarded as being distinct progression as compared with the policies and service of other stations. While the company has not reached a point where it has been unable to provide for all who might desire service, it is prepared to give preference to the machines for which it is agent should there be occasion to refuse garaging because of lack of space for storage, and in undertaking repair and restoration work, for it is maintained that while the company will give all the attention possible for those who desire work done it is obligated to consider those who own the makes of machines it sells, and those who purchased through the company, before others who have no reason to claim consideration. Not only this, the company will event-



Charging Panel and the Leads in the Garage of the Empire State General Vehicle Company, Where the Gravity System Is Used.

ually devote its endeavors principally and perhaps wholly to service vehicles, and will give over pleasure machines when this can be done consistently. Having divided its garage into divisions for electric and gasoline wagons and cars, it is intended that the one shall not in any way encroach upon the other, and with the growth of the business there shall be the same character of attention given to either, no matter what the number.

In the conduct of the garage it will be understood that the two departments are separate and distinct, and the service given in either is upon an entirely different basis. In this article the electric department will be considered at length because it differs materially from other electric garages, and the gasoline department is conducted along lines which are generally the vogue with public service stations. The matter of pleasure vehicles will be but briefly referred to.

The basis of the service is shown by the price schedule which accompanies this discussion.

It will be noted that the schedule of prices for the gasoline pleasure cars provide for the service that is generally given in garages, and besides washing and polishing such assistance as might be desired occasionally, such as a carburetor adjustment, tightening a bolt, changing a tire or help that can be given consistently. Work that would require time, or time and material, is charged for in addition. The garage has a full stock of supplies and accessories that are sold at standard prices and with the guarantees given by the manufacturers.

The prices for gasoline trucks and wagons are for storage only, and as the drivers of these machines are expected to look after their outfits, even to washing, the garage employees are not called upon to assist them. If work of any kind is done or material or supplies furnished, additional charge is made. For the machines for which the company is agent a stock of parts is kept and these are available as desired, but if a replacement is necessary the driver does it or, if the work is performed by the garage men, a charge for the time and part is made. Of course fuel and lubricants are furnished and charged to the owner as delivered.

Gasoline Pleasure Cars.

Limousine, a month	$35
Large touring car, a month	35
Small touring car, a month	20
Runabouts, a month	20

Prices include washing, polishing and minor adjustments.

Electric Pleasure Cars.

Coupes and victorias, a month	$35

Price includes charging, washing, polishing, delivery and minor adjustments.

Gasoline Trucks and Wagons.

Three tons, a month	$20
2.5 tons, a month	20
One ton, a month	20
1000 pounds, a month	15

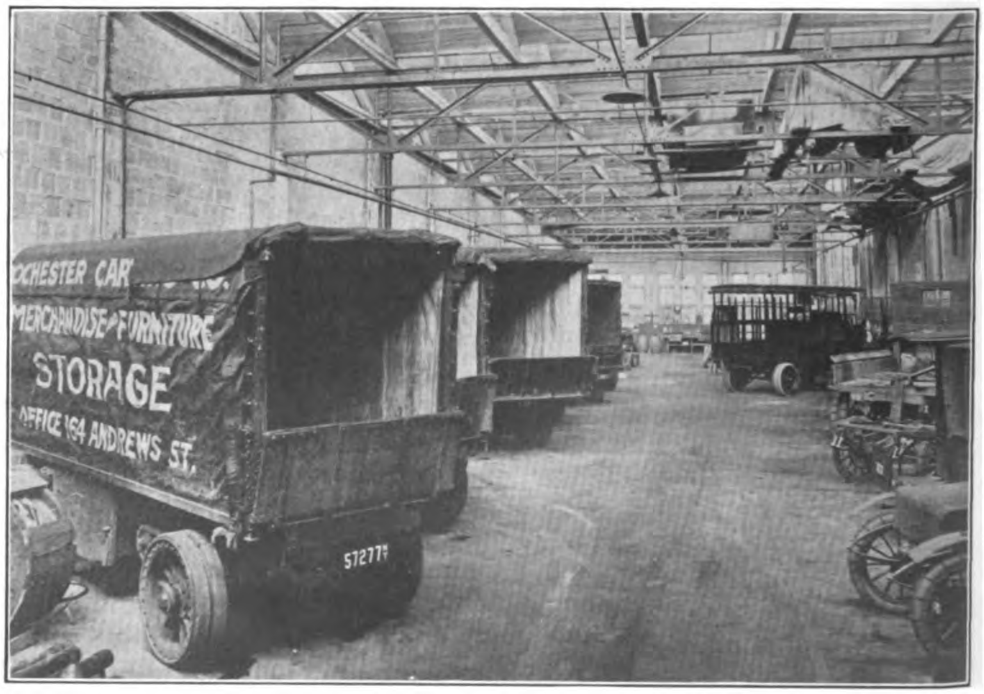
No washing or polishing or minor adjustments, merely storage space, included in these prices.

Electric Trucks and Wagons.

Five tons, a month	$60
3.5 tons, a month	55
Two tons, a month	50
One ton, a month	40
1000 pounds, a month	35
700 pounds, a month	35

Prices include washing, polishing, charging and minor adjustments.

With reference to the gasoline vehicle department of the garage and the handling of the fuel, lubricants, supplies and accessories, conventional methods are the vogue and system is observed that there may be no loss by waste or neglect to make record of deliveries, or from the drivers helping themselves to what might be left uncared or not accounted for.



Repair Shop of the Empire State General Vehicle Company's Garage Lighted by a Saw-Tooth Roof and Spacious Enough for Much Work at One Time.

Space No. Date

Name Address

Make of Car Type License No.

Make of Battery Type No. of Cells No. of Trays

Rate per Month

General Condition of Car when Brought in

Remarks

STORAGE

From	To	From	To	Remarks

Card Record Filled When a Contract for Service Is Made for the Electric Section and Continued During Period Machine Is Garaged; Card Five Inches Length and Eight Inches Width, Printed in Black on White—Reverse of Card Below.

The electric department, however, gives an entirely different character of attention, and it will be seen that this differs from any other in that the machine may be garaged under any one of four services. The pleasure vehicles are provided for at a stated price, as may be the wagons and trucks, or the second classification may be on a maintenance service, or a storage and battery mileage plan, while the owner can, if he desires, garage his own machine and use rented batteries.

In this department the records are as simple as possible and as the battery service was but recently inaugurated the forms that are at present utilized may be changed or amplified as may seem best with greater experience. The accounting is not to be analyzed, but the records used in connection with the work and from which the charges for service are established will be dealt with in the sequence of their use.

When a vehicle is received at the garage form No. 1 is filled, and this, it will be noted, indicates the number of the space to be occupied, the date, the name and address of the owner, the make of the vehicle, the type, state license or registration number, the make of the battery, type of battery, number of cells, number of trays, the rate to be charged monthly, and a statement of the general condition of the machine when received. This information is entered on a card that is kept in a file. This card has a portion of the obverse for "remarks" with relation to the condition or the service, and the reverse is intended to show the periods of storage and whatever facts may be desirable to record. The card shows from whom orders for work and material shall be received, who shall drive it, and from whom the authority with relation to attention outside of that provided for by the monthly charge may come, either the owner or his driver, or work may be left to the discretion of the garage foreman when the report has been made to that official.

The pleasure cars are delivered wherever ordered by "chasers," and where the distance justifies car fare is provided for the return of the young men doing this work. When cars are sent for to be returned to the garage car fare is allowed. This is an expense that must be accounted for. To have accurate knowledge of the use of the pleasure machines what is known as a "Daily Garage Sheet" is kept, and this shows the name and address of each owner, the time a call is received, the time the machine is sent out, the name of the "chaser" in charge of it, the time he returns and whether or not car fare is given; when the call is received for the return of the machine, the time the "chaser" leaves the garage, the time he returns, whether car fare is given, the condition of the car and where it was called. If the car is washed and charged these facts are also noted, so that a very good knowledge of the service of the vehicle may be had and the authority for its use can be established. This record is filed and it will give useful information with relation to the use of each machine.

With the electric wagon or truck taken for service the same form of card is filled, and this is placed in a separate file. The time the machine is required for use each day and the addresses of the driver and owner are noted. The authority for work is established and it is understood that so far as is practicable the machine will be ready for use as desired. That is, when a

DAILY GARAGE SHEET Date

NAME	ADDRESS	TIME CALLED	OUT			CAR FARE	TIME CALLED	IN			CAR FARE	CONDITION OF CAR	WORK		WHERE CALLED
			OUT	RET'D	CHASER			OUT	RET'D	CHASER			WASH	CHG.	

"Daily Garage Sheet" Used in Recording the Service of the Electric Pleasure Cars, 8.5 Inches Length and 14 Inches Width, Printed with Black on White with Red Longitudinal and Blue Transverse Rules, Arranged for 15 Entries.

Date
Employee's No.
RATE

Job No.	No. Hrs.	Work Done

"Time Card" Six Inches Length and 4.25 Inches Width, Printed in Black on Yellow Card with Rules for 12 Entries.

work is undertaken it will be completed so that the wagon will be in an operative condition if this is possible.

Next in the office what is known as a "job" is made out and this is a form of record on which will be entered all the work not included in the monthly service charge and material or parts that may be needed. This "job" is given a number and this "number" is posted on a board in the repair shop together with the name of the owner and the identity of the machine. When work of any character is performed it is credited to the "job" number, and this record goes to the office, and from this the charge is made.

The posting of the number makes it easy for the mechanics to keep their time wherever it is given, and as the time is thus credited to each job or number the work done may always be accounted for and the cost of labor established. From this "job" record in the office the monthly bill is made out and the entries, plus the monthly price paid, show the amount payable.

All of the time of the mechanics is accounted for on a card that is issued for each man for each day, and this shows the date, the name and the rate of wages paid. On the card is entered the number of the "job," the number of hours and the work done with reference to each assignment by the foreman, and this card accounts for the entire time during which the man is employed.

The "job," as it is known, is actually a shop order, which is made out in duplicate, having a serial number that is assigned for a month to a single vehicle for convenience of record, and this applies to every machine in the electric section. The order is filled with the date, registration number of the customer, the name, the terms and the date the work is to be completed when work is performed for those in the gasoline section or for casual or transient customers. As the orders for work are issued daily, the necessity of posting those numbers that are to be continued through the month is obvious, for these numbers do not necessarily continue serially, although the orders are so numbered. To simplify the office and repair shop record the electric and gasoline sections of the garage are not separated with reference to the repairing, although in the accounting the business is divided that there may be accurate knowledge of either division.

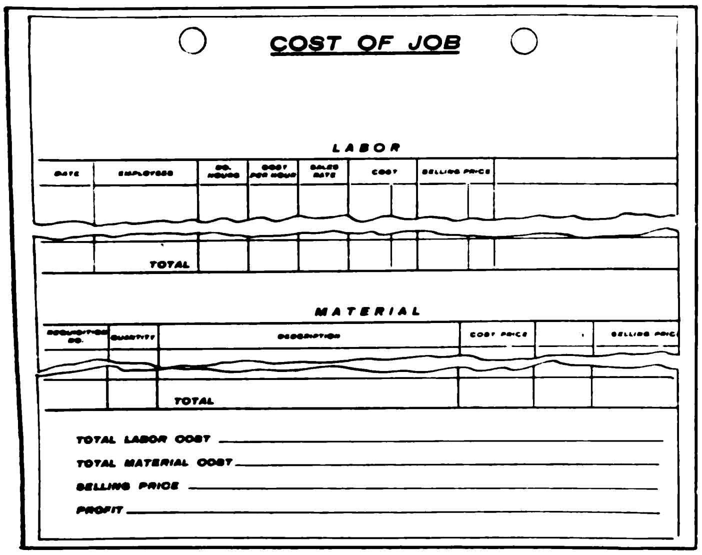
The copies of these orders are issued to the repair shop, and if the numbers are assigned for a month then whatever should be charged to them during that period in the way of material or time are entered on the copies by the foremen when a requisition is made or work is done, together with the price a unit and the total amount. The original order is retained in the office and on this on the obverse is made the same entries as are shown by the copy in the repair shop, but on the reverse is shown the "cost of job," which gives the dates, names of employees, number of hours, cost an hour, sales rate, cost and selling price, with reference to labor, and the requisition numbers, quantity, description, cost price and selling price with reference to material, together with the total costs of labor and

FACTORY ORDER JOB NO.
EMPIRE STATE GENERAL VEHICLE CO.
ROCHESTER N Y

DATE CUSTOMER'S NO.
NAME TERMS
WORK TO BE DONE

QUANTITY	DESCRIPTION OF WORK DONE	PRICE	AMOUNT

Shop or "Job" Order, Obverse of Original, Seven Inches Length and 11 Inches Width, Printed in Black on White, Ruled for 11 Entries; Copy in Black on Blue—Cut for Loose Leaf Binding.



COST OF JOB

LABOR

Date	Employees	No. Hours	Cost per Hour	Sales Rate	Cost	Selling Price	
	Total						

MATERIAL

Requisition No.	Quantity	Description	Cost Price		Selling Price
		Total			

Total Labor Cost

Total Material Cost

Selling Price

Profit

Reverse of Shop or "Job" Order Original, 11 Inches Length and Seven Inches Width, Printed in Black on White, Ruled for 11 Entries for Labor and Nine Entries for Material.

material, the selling price of the aggregate and the profit. From this "cost of job" the bill is made out and every detail can be supplied by the requisitions and time cards. The orders are kept in loose leaf binders and are a record of all work done in the repair shop.

As may be assumed the orders refer to work other than actual labor on the mechanism of the wagons or cars and include every form of attention to the batteries, aside from that required by the provisions of the contract for service. For repairing or restoration it is necessary to have material or parts, and these cannot be delivered from the stockroom without a requisition, and this must show the number of the job, the date, the name and address of the person for whom the work is being done, and the quantity of material required, and when this is delivered the number of the bin and the price a unit and the total amount is entered. The delivery is receipted for.

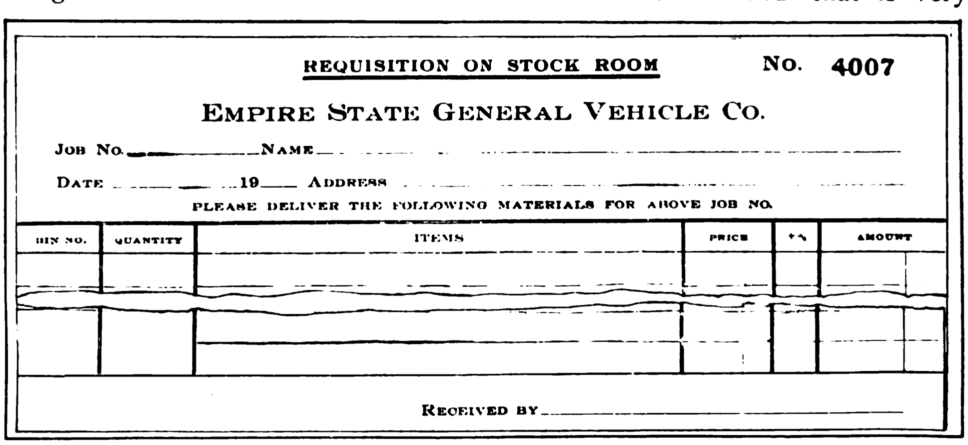
The electric machine on a service basis is taken out for the day, for instance, by the driver. On the return at night the driver makes report to the foreman of any condition of operation that indicates the need of adjustment or restoration or attention, and this refers to the battery as well as the mechanism. The foreman examines the machine and then gives instructions for whatever work and the use of such material as may be necessary to make repair, but in the absence of his authority, when such is required from the owner, this is obtained. So far as possible all work is planned so there will be the least retardation of a customer's service, and if it is imperative notification is given the owner so that he may arrange for a temporary substitute for his machine.

If the work is outside of the requirements of the service then a "job" is made out as has been outlined, but if not the care is given in the regular work. If the machine does not require attention by the foreman, it is washed, driven to its regular space and placed on charge. If work is necessary that may be dirty, this work is done before the machine is washed, in which event charging may be delayed, but this is the exception. Generally work may be done while the battery is being charged, and when charging is completed a street test is made if this is considered necessary by the foreman.

In this garage the charging of batteries is by current supplied by a motor generator set, and instead of the usual multiple switchboard or panel there are a series of panels along either side of the garage which are each arranged to charge four vehicles at a time. The panels are at regular intervals, and at either side of each panel are two leads for charging, as is shown in the accompanying illustration. These are directly back of the machines stored in the spaces indicated by the numbers on the walls, and it is but a few feet from any of the four machines charged at any given panel, so that a great deal of time in reading instruments is saved for the man charging.

The original installation for charging consisted of five motor generator sets of 120 volts of various capacities, and by these current is supplied to each of the charging panels or stations. By placing both switches of each circuit in an upright position a current of 80 volts is available and by placing them in a downward position, a current of 120 volts is obtained. If it is desired to reduce the amperage below the normal this is accomplished by cutting in on the circuits with the rheostats shown with each panel.

A new charging system is being installed that will be in operation in a short time—perhaps a few days—and this will consist of a Westinghouse three-piece apparatus. The motor or centre unit is a 4150-volt synchronous motor, 285 horsepower, 60-cycle three-phase, 46 amperes a phase, 900 revolutions a minute. The generator at the left is a 145-kilowatt 120-volt 1210 amperes, and the generator at the right is rated at 45 kilowatts, 80 volts, 262.5 amperes. By using this installation a combination is afforded that is very



REQUISITION ON STOCK ROOM No. 4007

EMPIRE STATE GENERAL VEHICLE CO.

Job No. ____ Name ____

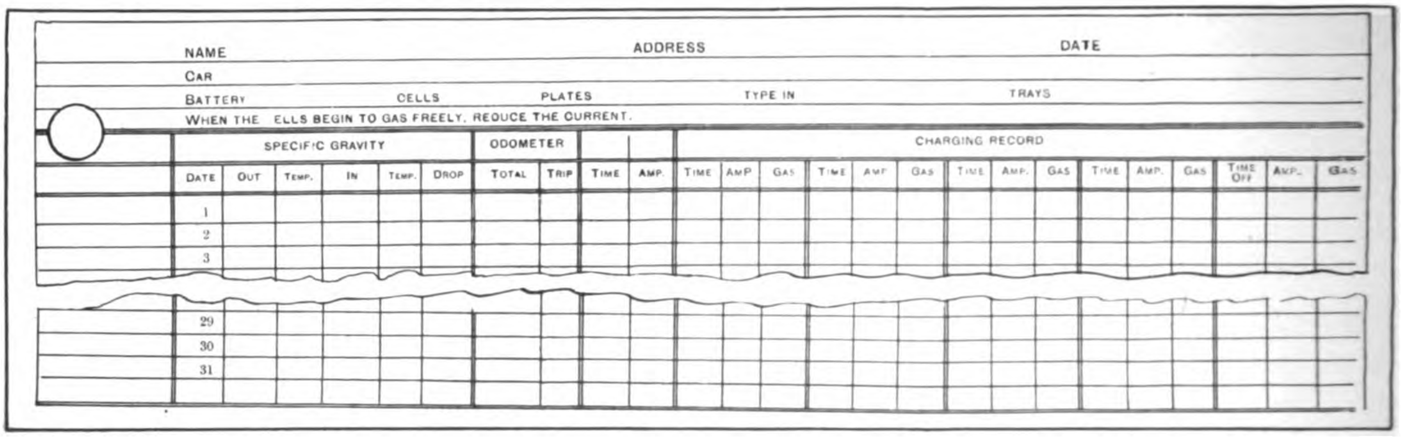
Date ____ 19____ Address ____

PLEASE DELIVER THE FOLLOWING MATERIALS FOR ABOVE JOB NO.

Bin No.	Quantity	Items	Price		Amount

Received by ____

Stock Requisition, Five Inches Length and Eight Inches Width, in Black on Blue and for Nine Entries.



NAME ADDRESS DATE

CAR

BATTERY CELLS PLATES TYPE IN TRAYS

WHEN THE ELLS BEGIN TO GAS FREELY, REDUCE THE CURRENT.

	SPECIFIC GRAVITY						ODOMETER				CHARGING RECORD														
	DATE	OUT	TEMP.	IN	TEMP.	DROP	TOTAL	TRIP	TIME	AMP.	TIME	AMP	GAS	TIME	AMP	GAS	TIME	AMP.	GAS	TIME	AMP.	GAS	TIME OFF	AMP.	GAS
	1																								
	2																								
	3																								
	29																								
	30																								
	31																								

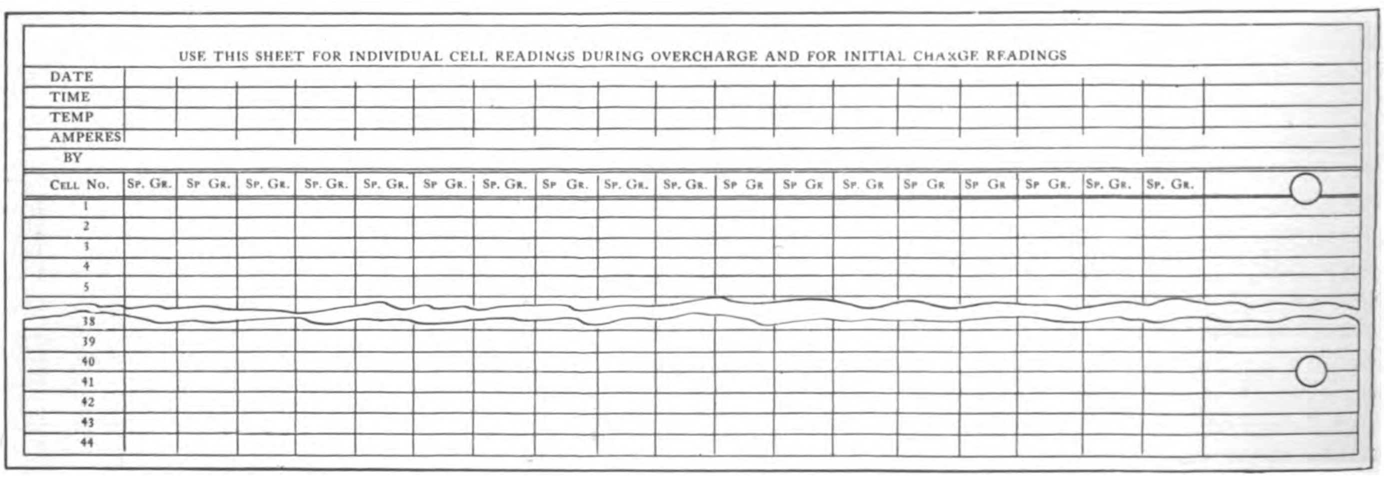
Battery Charging Sheet, Which Requires a Daily Entry for Each Month, Showing the Specific Gravity, Odometer and Charge Records, and the Relative Work Accomplished by Vehicle Miles, on Sheet Eight Inches Length and 11 Inches Width, Printed in Black on White and Ruled Longitudinally with Blue and Transversely with Red; Perforated for Loose Leaf Binding.

economical, as the pleasure cars do not require more than 80 volts, and it is unnecessary to lose the difference in voltage that would be lost were but one large 120-volt generator used.

It will be noted that the panels are unusual in that they have but one indicating instrument, an ammeter, and no voltmeter. The switches afford a variance in the amperage of the current, and this is shown by the ammeter, but the voltage of the batteries is learned by gravity test. The battery of a machine is drawn out of the cradle so that a cell can be selected for a pilot, and during the period of charging the specific gravity of the cell is taken at frequent intervals, and the condition of the charge is accurately known by the reading of the hydrometer. The amperage is continued at the initial rate until it is shown by the gravity of the electrolyte that it should be reduced, and then it is maintained at the lowered rate until the cell has reached the gravity that indicates the charge is completed. It is maintained that the constant observation of the pilot cell gives a very accurate knowledge of the condition of the battery and that less current is used than when the readings of a voltmeter are accepted. Besides this it is possible to detect conditions that might not otherwise be known until a considerable loss of capacity made it evident.

The battery charging sheet gives the name and address of the owner of the machine, the date, make of vehicle, make, number of cells, number of plates and number of trays and the type of battery. There is an entry made for each day of the month, and this gives the specific gravity of the battery as shown by the pilot cell on leaving the garage and the temperature of the battery, and similar readings are taken when the machine returns, and the difference in gravity is noted, with the total and trip readings of the odometer. The record of charging shows the time when it was begun, the amperage, the time when it was reduced and the amperage reduced to, and the condition as to "gassing." There are three entries possible for each day against any one date, which is sufficient to provide for any condition that may arise. Once each month each vehicle battery is given an overcharge and then each cell is tested for specific gravity and the electrolyte is equalized, so that the battery is brought to its highest efficiency. On the reverse side of the charging sheet is noted the date, time, temperature and amperage of the battery, and the last three items are entered each time the gravity of each cell is taken, and no less than 16 readings are required, which indicate with great exactness the condition of each cell during the entire period of charging.

It will be seen that the charging sheet is a very interesting record and the method of charging requires



USE THIS SHEET FOR INDIVIDUAL CELL READINGS DURING OVERCHARGE AND FOR INITIAL CHARGE READINGS

DATE																		
TIME																		
TEMP																		
AMPERES																		
BY																		
CELL No.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.	SP. GR.
1																		
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38																		
39																		
40																		
41																		
42																		
43																		
44																		

Reverse of Battery Charging Sheet, Used to Record Individual Cell Readings During the Period of Overcharge, Given Monthly. This Showing the Condition of the Battery and Its Units.

a thorough knowledge of the battery that must insure an unusual efficiency. While it is possible that an accident might cause a damage that would result in loss of capacity, and necessitate a repair, the normal changes can be very closely followed and conditions anticipated from the facts of record.

The maintenance service of the company is worked out on the basis of a year's contract, and the charges provide for every expense in connection with the use of a vehicle save insurance, painting and repairs resultant from accidents beyond the control of the company. It includes storage, washing, polishing, charging, repairs of all kinds resulting from wear, adjustments, overhauling, battery restoration, and oiling, greasing and other attention, covering both labor and material. The year is taken as 300 working days, for one week is necessary to thoroughly overhaul the machine and repair and restore it. But to be able to secure this service a machine must be new or as good as new. When the contract is made the company guarantees to have the machine ready for use each working day morning, and where there is failure to have the vehicle ready the company will rebate the maintenance charge for the day. Where the time is lost through a fault beyond the control of the company then the charge is continued and the owner suffers the loss.

The maintenance charge is as follows:

Vehicle	A Day	A Year
700-pound wagon	$3.00	$900
1,000-pound wagon	3.50	1050
2,000 pound wagon	4.00	1200
4,000-pound wagon	4.50	1350
7,000-pound truck	5.75	1725
10,000-pound truck	6.25	1875

In addition to this the owner must consider his fixed charges, which include interest on investment, depreciation, taxes, insurance, and to which is added the wages of the driver and the cost of accidents for which the driver or others are responsible.

The battery rental service will be without reference to character or type of vehicle so long as it is built for a standard size of battery. The company will sell a vehicle without a battery and will make contract by which, for the payment of a service charge (which must be paid whether or not the machine is used), the owner can have a fully charged battery installed in his wagon as often as he desires, and when the charge is exhausted or well reduced another may be secured, so that the machine may be kept in operation constantly if required. Payment will be made on the basis of miles the battery is driven, this to be indicated by the odometer on the vehicle, and the greater the mileage the less the battery cost a mile. The time required for changing batteries will be comparatively brief, from three to five minutes being necessary unless something unexpected causes delay. With this service the owner will be relieved of all thoughts of batteries, for he has nothing to buy, nothing to maintain, and he is assured of a practically constant mileage and no loss of capacity through deterioration.

The battery rental service has been carefully worked out from known facts and data, but the details as determined may be changed or modified when it has been given the test of operation, and its cost is known to the company. From the viewpoint of the vehicle owner, however, it has everything to recommend it.

There are now stored in the garage 17 electric wagons and trucks, 12 electric pleasure cars, four gasoline pleasure cars and eight gasoline trucks, a total of 41 machines. The garage force consists of three men in the battery room, five mechanics and two "chasers," a total of 10, and the mechanics make repairs on all vehicles that come in besides the machines given service on a monthly contract. The night force includes one batteryman, one "chaser," two washers, one man who oils and greases cars and trucks, and one general repairman.

EDISON AWARDED RATHENAU MEDAL.

Inventor Honored for His Services in Safeguarding Workers by Perfecting Battery.

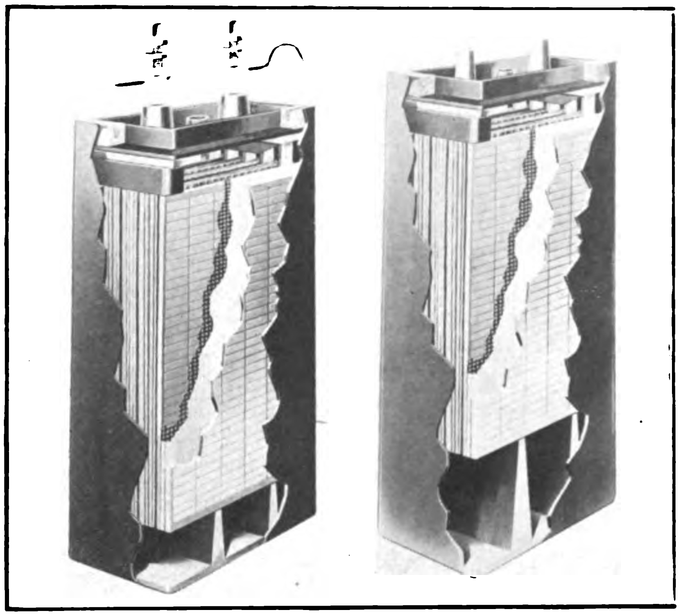
The Rathenau medal, last summer placed at the disposal of the American Museum of Safety by the Allgemeine Electricitats Gesellschaft of Berlin, to be awarded annually for the best device or process in the electrical industry for safeguarding life and health, was bestowed upon Thomas Alva Edison at a meeting of the museum held at the United Engineering Societies building, 29 West Thirty-ninth street, New York City, the evening of Jan. 23. The inventions for which Mr. Edison was honored are the results of his latest experiments with the storage battery, and recognition of his application of his battery in new forms with special adjuncts in relation to safety in mines, tunnels, work under water, in factories where explosives are made, powder magazines and where explosive gases are generated or used. It is believed that the application of the battery in this field has reduced the hazard to workers fully 100 per cent.

The Rathenau medal was presented to Dr. Emil Rathenau, president and founder of the A. E. G., on his 70th birthday with the felicitations of Kaiser William for his services in the field of electro-technics. He introduced electric lighting into Germany and is an old friend of Mr. Edison. One medal is struck each year from the original die for the museum to award. The Scientific American medal, the Louis Livingston medal and the Travellers Insurance Company's medal were also awarded at this meeting, the last to the New York Edison Company for making safer the electric industry. President Arthur Williams presided and the awards were made by Prof. F. R. Hutton, chairman of the jury of awards.

The First National Bank of Boston has recently purchased its second White truck, made by the White Company, Cleveland, O. This machine, which is rated at 1500 pounds, is electrically lighted and all its locks are operated from the driver's seat, so that entrance is impossible without the knowledge and consent of the man at the wheel.

NEW FEATURES OF LBA STORAGE BATTERIES

THE Willard Storage Battery Company, Cleveland, showed at Madison Square Garden an improved battery cell for which extreme accessibility is claimed.



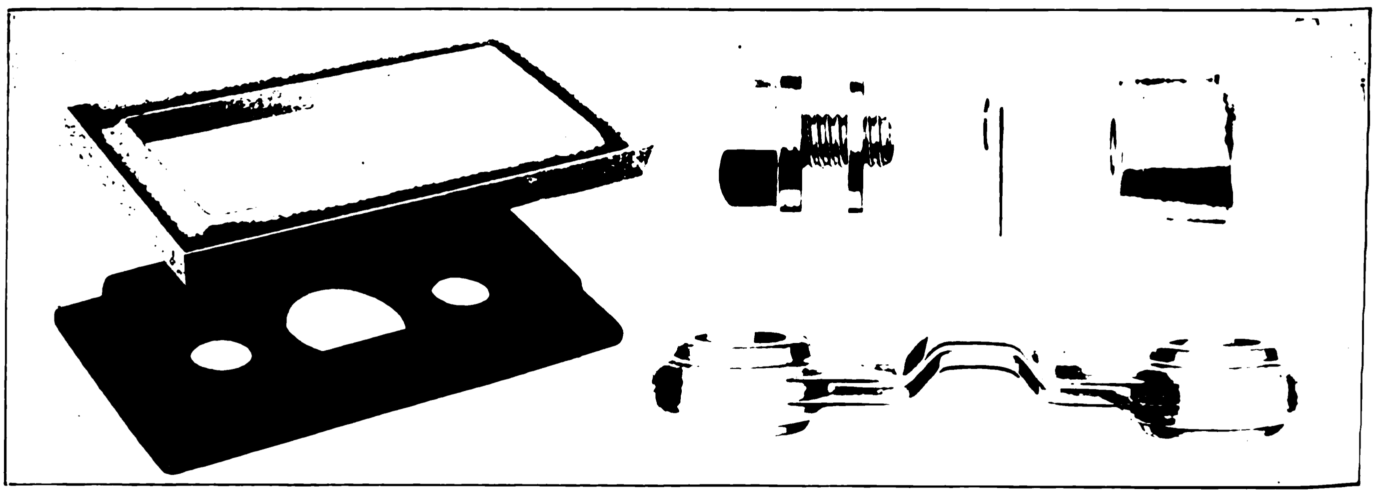
LBA Battery Cells: At Left, Low Bridge Type with Bolted Connectors; at Right, High Bridge Sealed Cover Construction.

One feature is a return to the use of bolted connectors, which type was originally used by battery makers and rejected because of the corrosion from the electrolyte, and another is an improved form of cover which consists of a hard rubber plate and is used with a gasket of pure gum.

The custom has been for battery makers to seal the cells with a pitch or asphalt compound, heated to fluidity and poured into the top of the jars. When this cools it is necessary to cut or break it to expose the element, and in repair or restoration the seal must be replaced and the connectors "burned," which means melting the lead, so that this will be a solid piece when cool. Corroded matter will, if permitted to accumulate, cause a short circuit or will insulate conductors, and it was to prevent this that the "burned" connectors were used. It is evident enough that time must be taken to cut the lead and to remove the sealed cover, while it is also necessary to have a tank of hydrogen gas or some other source of intense heat and the apparatus to "burn" the lead.

The condition of the battery can always be best determined by careful observation, which is not possible with the sealed type without cost for labor and perhaps material, although hydrometer readings may be made to test the electrolyte. It is maintained that with the LBA batteries the cells may be opened by the removal of the bolts and connectors and lifting the hard rubber covers and the soft rubber gaskets, minimizing time and labor and eliminating the special facilities for and the expert attention required for lead burning.

The jars are built with heavy walls to resist breakage, and with standard and extra high bridges to support the element. The latter construction affords more space for sediment to deposit in the cell. Vent plugs are made to condense the gas from charging by breaking the bubbles before they escape. The LBA plates are made by a process that insures the strength and service required for electric vehicle propulsion. Types J and K of the LBA vehicle batteries have heavy plates of standard thickness and are assembled in elements of from five to 21 plates. These types are made with the new bolted connectors and rubber gaskets, or with the old type connectors and sealed covers, and with either high or low bridge jars. Types L and M have medium plates and are assembled in elements from seven to 23 plates, the capacity of the cell being more for the same weight and bulk than with types J and K. These are also made with the low and high bridge, and it is held that the latter form will not short circuit from sediment during the life of the battery. Types N and O have light plates and the elements are composed of from seven to 27 plates. It is claimed the capacity is greater than the other and affords increased mileage. The company also produces batteries that are especially adapted for lighting and starting purposes.



LBA Battery Construction: At Left, Hard Rubber Cover and Soft Rubber Gasket for Quick Sealing of Jar; at Right, Type of Cell and Bolt Connector Affording Greater Accessibility.

ELECTRIC VEHICLE PRACTICE.

Wagons and Trucks of Today the Combined Development of Motor, Battery and Chassis by Scientific Engineering and Patient Experiment—the Result of Concentration on Practical Standard Types Adapted to Varying Conditions.

By William W. Scott.

THE development of the electric vehicle has been accomplished by numerous factors, and while it is true that design has been worked out purely

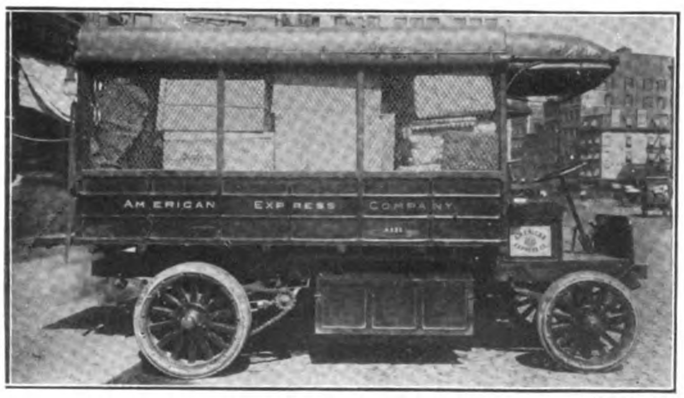
Vehicle Equipment Truck, Double Motor Pedestal Type, Built in 1901—An Ornate Construction as Compared with Wagons of Today.

through engineering experience, it is also a fact that motors have been perfected by concerns having the services of the best experts in America, if not in the world, while the batteries have been brought to an equally high efficiency through the endeavors of men internationally recognized for their ability. To illustrate, the same types of motors used for propelling vehicles have been so generally used for prime movers that commercial necessity impelled the greatest care and skill in their production, and justified the constant observation and experimentation of the best of expert engineers. Railway and street railway propulsion established the need of the type of motor used in carriages and wagons, and these have been so improved and refined that it can be said they can be used for years with no other attention than lubrication of the bearings and adjustment of the commutator brushes. Very recently the writer noted in New York the commutator of a motor that had been used daily in a truck for more than three years, and during that time had not been polished. The metal was in better condition than the day the motor was installed in the machine, and it has been driven more than 30,000 miles. This is an example of the endurance of electric motors.

The initial experience of the General Electric Company, which is probably the largest maker of motors of the world, with vehicle motors, covers a period of more than 16 years. The possibilities of the electric motor was understood and Herman Lemp of the company, who was at that time located at Lynn, Mass., decided to experiment exhaustively. In March, 1897, the work of building a six-passenger vehicle was started, and the machine was given its first trial July 2 of that year. It is desirable to describe briefly this machine, for it was an important factor in the industry.

The battery was underslung between the wheels, and the cells were always connected in series. The drive was through the rear axle with a single reduction through herringbone gears, enclosed and running in oil. The motor was designed for high efficiency on overloads regardless of weight. The armature had two windings with two commutators, and these windings could be connected through a controller in series or in multiple. The motor was spring suspended from the body at one side to lessen shocks in starting. The front axle was divided and the wheels were steered by a lever movement through cranks. The controller was very accessible, being located under the seat. A single handle operated the controller drum, the handle operating in a Z-shaped slot to prevent an unintentional reversal.

The controller had six positions—three forward, one backward and two at rest. In the first forward position the windings of the armature were in series; in the second forward position the windings and the armature were in multiple, and in the third forward position the field was cut or divided. In one of the rest positions an electric brake was used. The direction of the motion of the controller handle indicated the direction in which the carriage would move. Attached to the controller was a brake switch which could be thrown open by the application of the foot brake. This could not be closed until the handle had been brought to zero, when it would automatically restore the circuit. A removable key under the con-



Atlantic Truck, 3.5 Tons, a Typical Standard Construction, with Single Motor and Double Chain Reduction.

troller handle permitted the operator to open the circuit when leaving the vehicle, this preventing movement of the machine by unauthorized persons. An ex-

panding brake was used on the rear wheels. On a single battery charge the radius of movement was approximately 35 miles. The vehicle was at different

Commercial Two-Ton Wagon, Driven by Two Motors and Concentric Gearing That Gives the Necessary Reduction.

times equipped with pneumatic tires on wire wheels, and solid rubber tires on wooden or artillery wheels, the latter being finally adopted as most efficient.

It is exceedingly probable that were motor development dependent entirely upon the number used for vehicle propulsion but comparatively little progress would have been made, but commercial necessities impelled a constant endeavor to improve and perfect. In developing the motor the precise engineering data available have been of extreme value. The manufacturers had the service of the best of scientists and all that could be desired for laboratory and other equipment, and research and experiment was systematic and with definite results. As may be understood, the utilization of the enormous possibilities of electric power was dependent upon the economy of its use, and the main factor was the efficiency and dependability of the motor. Service in a large diversity of uses was considered in experimentation.

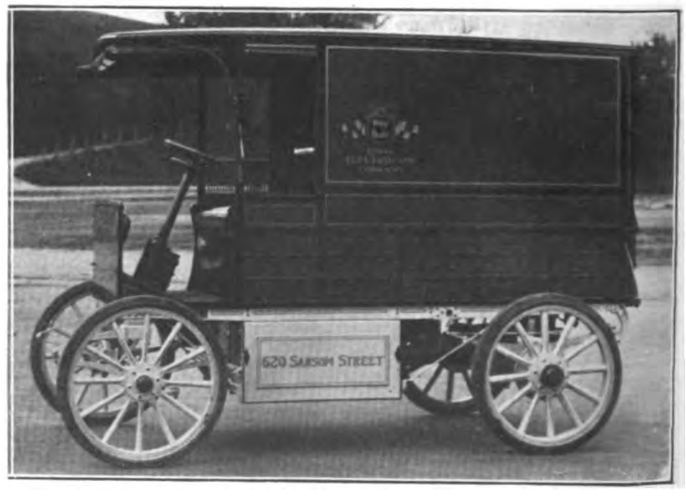
The policies of the large electric manufacturing companies may be said to be very nearly uniform, and so far as is possible they seek to obtain the largest measure of results from their manufacturing rights. Progression and perfection are the objects of these organizations. The motors of years ago were well built and efficient, but these have been remarkably improved so far as longevity and endurance are concerned. It is impossible to predict the life of a motor given good care and well maintained, but it is a long period of years with constant service.

Electric vehicle batteries were not developed to the same extent as were the motors because there was not the demand for them, and neither was there the same resources of manufacturers with reference to development, for experimentation was costly and electric battery engineering had not advanced. There were two main purposes, the one to secure capacity and the other to insure endurance. It is not to be assumed that these could be attained at will and years were required to develop batteries that were considered as satisfactory. The first batteries were of the acid or lead type and to have capacity they were necessarily heavy, and as this was a load that must be carried the usefulness of the vehicles was proportionate to the weight and the power stored. Obviously a battery of large capacity would reduce the vehicle load because of its weight and to lessen the battery size would diminish the power and efficiency.

Not only this, battery cost was comparatively high and current could not be obtained save at prices that caused those considering these types of vehicles to hesitate, while experienced battery men were very few. Besides these conditions the charging facilities were confined to an occasional central station. It is extremely probable that had the development of the storage battery been through the use of vehicles alone comparatively little progress would have been made, but the value of electric energy for other purposes stimulated the research and experiment that brought about constant development.

The chassis builders first adapted animal vehicles to their needs and from these bases developed carriages and wagons as judgment dictated. The pioneers of the electric automobile were enterprising, capable men, and their works were remarkable from many points of view, but often conditions beyond their control militated against success. There were numerous constructions that were sound from engineering standpoints, but the uncertainty of the people as to the qualities of the machines and their capacities made the market precarious and without promise for those who built vehicles. It was not possible, however, to improve the machines without continued test and this meant for each designer a process of elimination and constant observation. There never was in the history of the electric vehicle what might be called enthusiasm for its use. The first machines were conceived for pleasure and were literally toys for persons of means, their chief recommendation being safety and comfort.

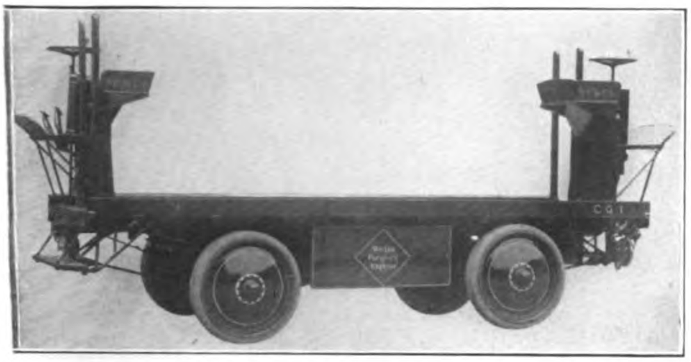
In America, at least, the initial wagon adapted to



Commercial 1000-Pound Wagon, This Being the First Electric Machine Built with a Worm Drive.

service purposes was built by Andrew L. Riker, and it may be said that Mr. Riker was the first to practically develop the electric for freight carrying. But

it was years after Mr. Riker turned to the building of steam and then gasoline automobiles that the qualities of the electric machines were realized. The elec-



Couple-Gear Four-Wheel Driven Truck, Each Wheel Containing a Motor with Its Armature Shaft Driving Pinions That Engage with Racks in the Inner Rim Peripheries.

tric wagon was first discredited and very generally rejected because of conditions which the manufacturers could not influence or control. It took years of patient endeavor and education of the people to make understood the practical economy and longevity of the vehicles, and it was necessary as well to unify the interests of the manufacturers of motors, controllers and appliances, of batteries, of chassis and the central stations to bring about the concerted development that has been realized. It was only when these factors were harmonized and systematic exploitation begun that the industry began to make progression that resulted in recognition.

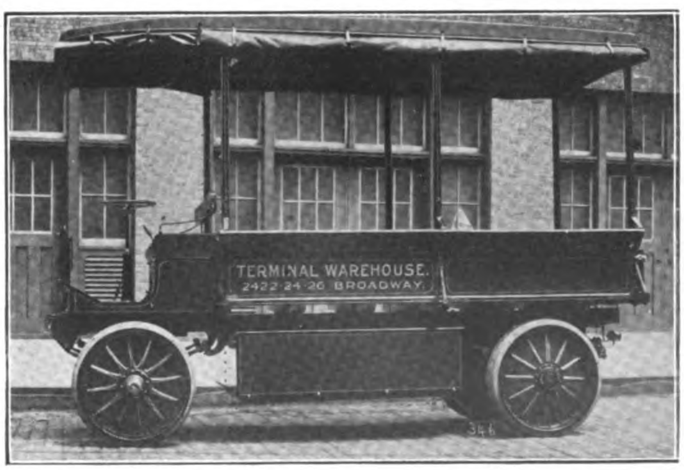
In the spring of 1898 the Riker 500-pound wagon was delivered to B. Altman & Co., which was followed by five others during the year. One of these wagons is now in use, and a Riker two-ton wagon delivered in March, 1901, has been used constantly since that time. It is possible to follow numerous instances of continual service, and generally of haulage that has tested the qualities of the vehicles to extremes. The history of the industry demonstrates that, as with the motor and controller, commercial possibilities brought about the development of the battery, and the chassis builders sought to improve their products with admirable judgment. The experience has generally been the perfection of a design, and generally each make has distinct characteristics which, while not varying from well established principles, are different adaptations.

The majority of electric vehicle builders of today have a single design and the machines vary in size. Others build two types and several build three, but with practically all the purpose is to standardize and perfect. Speed has never been a material quality sought by electric vehicle designers. Pleasure machines have been made desirable because of their especial qualifications for town and city use and their luxuriousness. There has been and probably will be for a long time to come, a limitation to the demand because of battery limitations, but for freight carrying and for purposes where a stated work is required the electric wagon has qualities that commend it. The formation of the Electric Vehicle Association of America for the purpose of exploiting the possibilities of the electric wagon has been exceedingly productive, for this organization has undertaken to crystallize public attention on the machines and the work for which they can be used.

The different bodies of representatives of central stations have also taken up the burden of interesting the stations generally in the commercial possibilities of the electric wagon and the promotion of their use, and the most practical method has been found in the co-operation of all these interests. Within the past two years a considerable number of central stations have included in their organization men who have actual knowledge of electric wagons, and who are developing business to a greater or less extent, doing the same missionary work that has so wonderfully increased the use of electricity for lighting and power. Others have co-operated with the representatives of manufacturers and agents for machines, and still others have become agents for the sale of wagons. There is nothing illogical to the policy and each month the number of central stations using electric wagons and promoting their use has increased.

The attitude of the electric vehicle industry, while competitive, is logically co-operative, and it may be stated that without exception service and not initial purchase price has been the object of the makers. By this is meant that the chassis have been carefully developed to insure constant work for years, and the prices have been established when assurance could be given that all of the requirements have been met. The electric wagons cannot be regarded as cheap, but when the period of service is measured by the cost it must be admitted they have the economy that prompts their use.

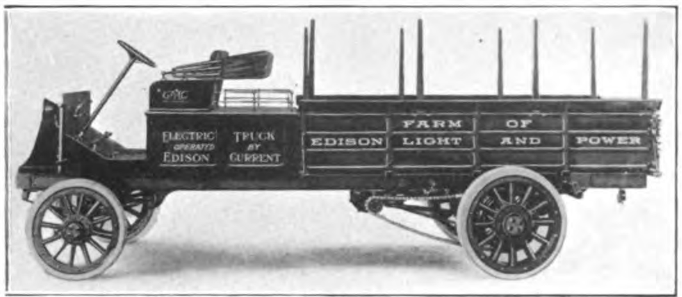
When comparisons are made of electrics of the earliest constructions and those of today, it will be noted that principles have varied but little, but there has been a remarkable perfection of designs, construc-



Walker Truck, the Motor Being Housed in a Casing That Serves as a Rear Axle and the Power Applied Through Spur Concentric Gearing.

tions, materials, workmanship and finish. The automobile industry created a demand for special metals, which have been used to afford greater strength and

endurance as well as lessening weight, the batteries are lighter and the capacities increased, and the chassis engineers have minimized frictional loss of power and also have protected the moving parts against wear.



G. M. C. Wagon, in Which the Power Is Transmitted by a Flexible Shaft Direct from the Motor to Countershaft.

Relative to vehicle installations, the sizes range from 500-pound to five-ton machines, and while there are those who specialize the lighter wagons only, the majority of the makers have produced a number of sizes up to five tons, while two firms making tractors have machines of this type with capacity of eight and 12 tons. The electric vehicles are driven by motors from storage batteries with the exception of one type, in which the current is supplied by a gasoline motor, this having an unlimited radius of movement. This machine is supplied as a tractor, if desired, and it is maintained that it affords the desirable qualities of both types.

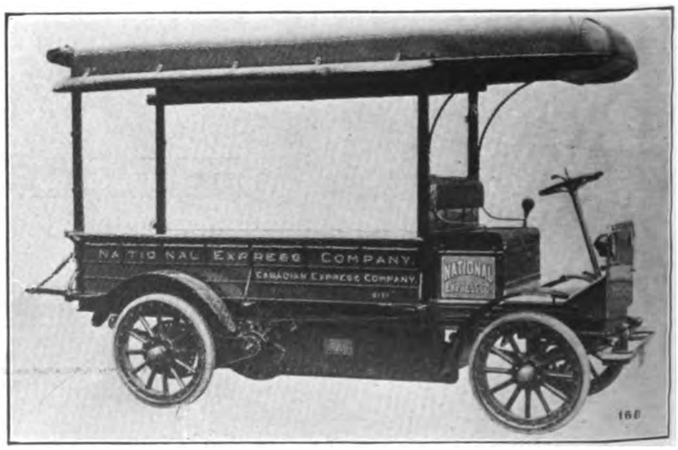
In the lightest electric service wagons the radius of movement is about 80 miles, this carrying a load of approximately 300 pounds the entire distance. The 500-pound wagons are rated at about 60 miles, and the 750-pound wagons at 50, while the other machines lessen in mileage to 35 in the case of the five-ton sizes. In the mileage rating of the wagons it should be remembered that this is to carry a load half of the distance over average streets and highways, but does not comprehend haulage over very steep grades or extremely rough roads. The battery capacity when the battery is new is considerably in excess of the rating, and with the acid or lead batteries there is a diminution in capacity that is proportionate to the number of charges and discharges. A battery may diminish in current output until it is not more than 5 per cent. of the maximum, but this will result from abuse or constant work. The diminution of battery capacity applies to the lead or acid type only, for there is no actual knowledge of the reduction with the alkali or nickel-iron cell. There is undoubtedly a loss, but this is so slow that no data have yet been compiled that will make possible an accurate estimate. It is not purposed to discuss the subject of batteries at this time, but the intention is to point out that the ratings are entirely conservative, and that for consideration of an installation these figures need not be discounted.

The range of service is not restricted with electric wagons so far as the character of freight to be carried is concerned. The designs are such that body equipment can be readily adapted, and bodies are more generally built by the manufacturers than for other types of machines. It is possible to use the electrics for any purpose that may be desired. One manufacturer is building each chassis in three lengths to afford different body lengths, but this instance is the exception, although there may be special construction when required.

With reference to bodies there is a very general disposition by the makers of chassis to insure against excess sizes of equipment and to equalize so far as possible the loads that may be carried, one manufacturer, at least, refusing to sanction the sale of a machine without first approving the body. This may appear to be extreme care, but it is practical insurance against a condition that might result in eventual damage and dissatisfaction.

There has been a very general use of standard types of bodies with electric wagons from the fact that express companies and concerns having large delivery equipment, such as department stores, breweries, packers, food product makers and the like, prefer to continue a uniform and distinctive appearance, because of the advertising value of machines that may be recognized at a glance. As with other forms of motor wagons, there are innumerable instances of special service bodies, but these are chosen with reference to their striking or individual design or from the fact that an unusual work is to be done.

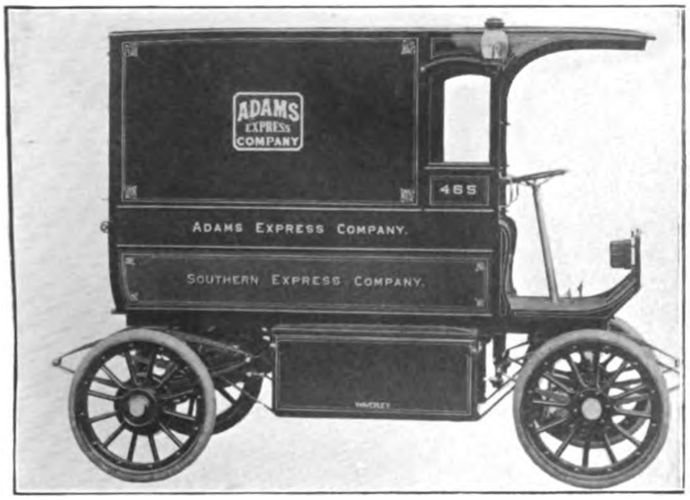
When electric machines were first used there was evident desire to use them with full realization of their advertising value, and this will be borne out by the illustration which shows the highly ornate truck built by the Vehicle Equipment Company in 1901 for the Germania Roofing Company. This was essentially a show wagon, and while it has a design that would stamp it as a service machine, the finish and ornamentation was such as would cause a present day observer to wonder why there was an apparently unnecessary expense incurred, when it was considered that the vehicle was to be used for purposes of general haulage.



Detroit Delivery Wagon Driven by a Single Motor with a Double Chain Reduction, Using an Edison Nickel-Iron or Alkali Battery.

In many instances there has been but little if any change in general proportions of bodies when animal and motor vehicles in existing installations are exam-

ined. By this is meant that the sizes of the old equipment could be retained so far as desired and the freight load distributed as comprehended in the design



Waverley 1000-Pound Wagon Driven by a Motor with First Reduction by Silent Chain to a Countershaft and Thence by Herringbone Gears to the Floating Rear Axle.

of the chassis. A casual examination of the bodies of wagons owned by large express and transportation companies will impress one with the fact that so far as possible the characteristics of the animal vehicles have been retained for two purposes, the one being the advertising value from public knowledge of appearance, and the other the construction has been proven to be substantial and economical.

DEPARTMENT STORES ABANDON HORSES.

Chicago and Indianapolis Firms Install Equipments of Waverley Wagons.

Mandel Brothers, Chicago, Ill., and L. S. Ayers & Co., Indianapolis, Ind., have abandoned delivery by horses and both firms have installed Waverley electric wagons. The change was made practically at the same time and at the opening of winter when the work might be regarded as heaviest of the year, because of the holiday trade. The service in either instance was faster and better than ever before. The Mandel equipment consists of 10 1000-pound shaft driven machines with special bodies, these beirlg built large enough to meet any requirement. Five wagons were equipped with batteries affording 60 miles driving on a single charge, and the other five with batteries of from 75 to 100 miles single charge capacity. The maximum speed is 14 miles an hour. The firm had previously used for several years both electric and gasoline machines.

Ayers & Co. installed six 1000-pound shaft driven delivery wagons and a one-ton delivery wagon for the furniture department. These machines are driven by drivers from the horse wagons, who were given instruction for a few days in the use of the electrics. The automobiles replaced 12 single and two two-horse wagons. The time of delivery has been shortened and on a suburban route one wagon does the work of two wagons, four horses and two men. The average mileage has been 35 with a maximum of 67. The average number of packages delivered during the rush season was 241 and the maximum number was 462. The daily cost of the use of this equipment has been estimated as follows: Operating expense, including garaging, charging, washing, polishing and replacement of parts, $2; fixed charges, including interest, depreciation, etc., $1.30, and wages, $2.50, this giving a total of $5.80.

NEW CARBURETOR FACTORY.

Milwaukee Inventor Decides to Locate Production Plant in Southern California.

A new factory for the manufacture of the Jensen carburetor has been established at Los Angeles, Cal., being located at 2413 South Grand avenue. The inventor is A. Rasmus Jensen of Milwaukee, Wis., who recently, with Mrs. Jensen and Otto S. Nick of Milwaukee, drove from that city to Los Angeles to test the vaporizer over the various mountain and valley roads.

Mr. Jensen decided to locate his factory in California and the plant was secured upon his arrival at Los Angeles. The carburetor is said to be absolutely automatic in its action, adjusting itself to heat and cold and to all changes of altitude, as well as to low and high speed of the motor. The mixture is varied by thermostat, which expands and contracts and thus governs the volume of gasoline and air that may be admitted to the intake manifold.

The Waverley Electric Wagon Delivery Service of L. S. Ayers & Co., Indianapolis, Ind.

FACILITIES MEAN EFFICIENCY.

Special Loading Equipment Large Factor in Delivery Service of Large Concern.

M. A. Newmark & Co., a large wholesale and importing firm at Los Angeles, Cal., utilizes 11 G. M. C. gasoline trucks of 3.5 and five tons capacity, which have replaced a large horse wagon equipment. The machines make practical a delivery that was not previously possible. The company, with the installation of the trucks sought to secure the largest measure of service, and to do this a number of wheeled bins were built. Two of these may be carried on the deck of each truck.

The warehouse of the company has an electric trolley system on each floor that converges at the elevator, and on the elevator is a continuation of the overhead rail, so that after the bins are loaded they may be carried by the trolley to the elevator and lowered to the first floor, where they are rolled onto the loading platform. As fast as the bins are filled they are sent to the platform, where they are in readiness when the trucks arrive. Empty bins are rolled from the trucks and replaced by those loaded, and the machines may be then driven away with very little loss of time. It is maintained that the company has increased the efficiency of its delivery 30 per cent. by the installation of the loading equipment.

The G. M. C. Gasoline Motor Truck Equipment of M. A. Newmark & Co., a Los Angeles, Cal., Wholesale and Importing Firm.

WILL BUILD WAGONS AND TRUCKS.

Edison Electric Vehicle Company of America Organized at Lawrence, Mass.

The Edison Electric Vehicle Company of America, Inc., has been organized at Lawrence, Mass., and has announced that it will build a complete line of electric wagons and trucks, the sizes being: Seven hundred and fifty pounds, known as model.8; 2000 pounds, known as model LLB; 4000 pounds, 7000 pounds and 10,000 pounds. The machines are built to a standard design and are fitted with Edison batteries.

The first vehicles produced are the smaller types and the larger will be built within a comparatively short time. Later on it is possible that pleasure vehicles will be manufactured.

MOTOR TRUCK CLUB BREAKFAST.

Members and Guests Hear Talks on Practical Subjects from Leading Factors in Industry.

One of the events incident to the show of service wagons at Madison Square Garden and Grand Central Palace was the breakfast given by the Motor Truck Club, an organization composed of men active in the power vehicle industry and trade, at its headquarters, 1845 Broadway, the morning of Jan. 21. Because of the demands of business it was believed best to have the gathering prior to the opening of the show for the day, and this plan brought together a company of nearly 300 men representing all sections of the country.

The breakfast was of six courses, and following it was an address of greeting by President D. C. Fenner, announcements by Secretary Ellis L. Howland, and a series of speeches, the subjects and speakers being: "Production," F. F. Beall, Packard Motor Car Company; "Advertising and Selling," P. D. Wagoner, president of the General Vehicle Company, whose paper was read by E. W. Curtis, Jr.; "Operating Motor Trucks," Elisha Flagg, Jr., general manager of maintenance of the American Express Company; "Motor Truck Service," George H. Duck, general service manager of the American Locomotive Company; "Past, Present, Future," Walter Wardrop, editor of Power Wagon.

The subjects were all timely and were well prepared, and the views and conclusions were especially interesting. The speakers dealt with practical data and facts obtained through experience and observation, relating to the marketing and utilization of power vehicle of all classes, and were heard with keen attention.

An article in the January issue of MOTOR TRUCK on "Motor Truck Springs and Their Work" was illustrated with sketches, which were modified by the author from certain illustrations in a book on "Leaf Springs, Their Characteristics and Methods of Specifications," published by the Sheldon Axle Company, Wilkesbarre, Penn. The absence of credit for reproduction from so excellent an authority prompts MOTOR TRUCK to make this acknowledgment.

Municipal Service Equipment

BOND ISSUE IN TOLEDO.

Plans Under Way for the Complete Motorization of Several City Departments.

The city council of Toledo, O., has passed an ordinance providing for a bond issue of $200,000 to be used for motorizing the fire department. Bonds are to be issued and bids for the motors asked for. In addition to the fire department the money made available, which will total $270,000 with the sale of the horses and apparatus, will enable virtually every city department to be motorized.

A motor truck will be bought for the fire alarm telegraph system, the electrical, building and smoke inspectors will be furnished with machines and several will be allotted to the police department. When this programme has been completed the motor equipment of Toledo will be second to none in the country.

KISSELKAR FOR QUINCY.

Massachusetts City Decides Upon Six-Cylinder Machine Made in Wisconsin.

An accompanying illustration presents the new combination hose and chemical engine made by the Kissel Motor Car Company, Hartford, Wis., for the fire department in Quincy, Mass. The entire vehicle is of special construction, in that the body, which was built to specifications supplied by the Quincy officials, is mounted on a KisselKar two-ton chassis and fitted with a 60 horsepower, six-cylinder motor.

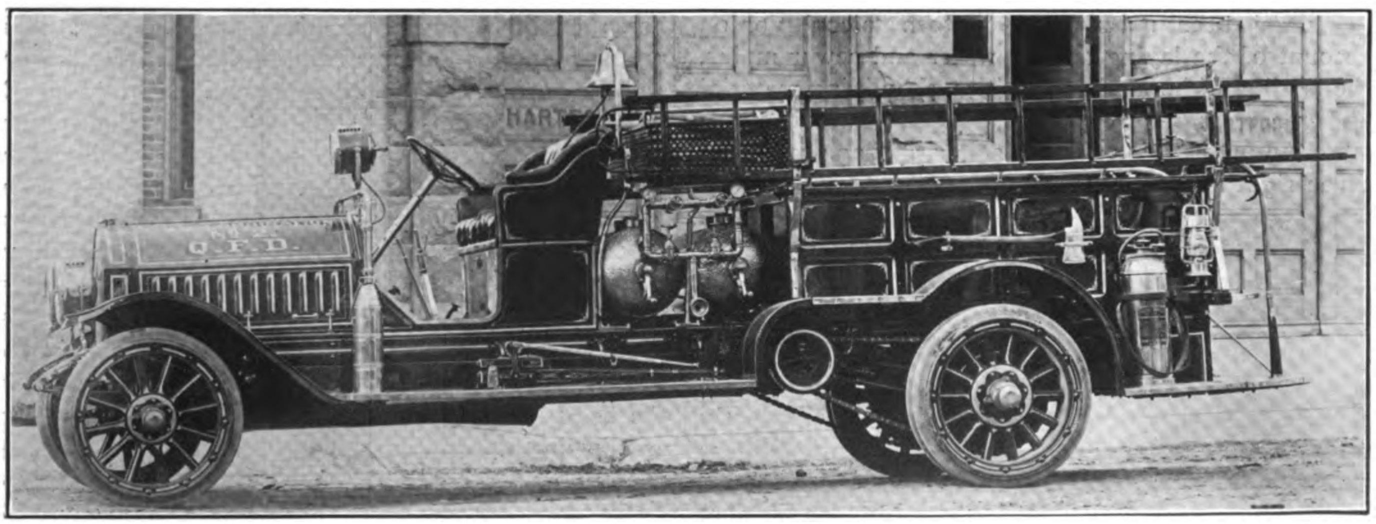
The equipment includes two large chemical tanks and the usual allotment of chemical and regulation fire hose, axes, extension ladders, hand extinguishers, lanterns, searchlight and tools. The assembly is particularly pleasing and is one in which the people of Quincy will take pardonable pride.

Similar equipment has been delivered recently to the fire departments in Salida and Sterling, Col., and the Kissel company finds the construction of apparatus of this nature is becoming a decidedly important branch of its work, which also includes the manufacture of Kissel Kar pleasure cars and commercial vehicles of all types.

POPE-HARTFORDS ARE EFFICIENT.

Fire Chief in San Francisco Satisfied That Motor Driven Apparatus Is Superior to Horses.

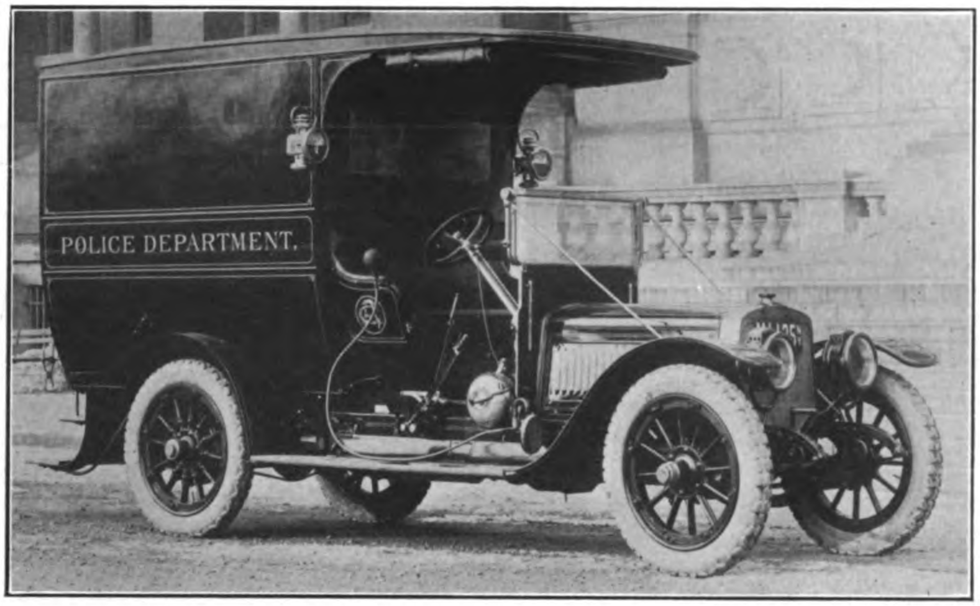
In providing automobile transportation to promote the working efficiency of various municipal departments, San Francisco ranks among the most progressive cities in the world. By the installation of motor driven vehicles the fire, police, education and health departments have within the last four years saved substantially in both time and money in conducting their affairs. Taking the fire department as an exam-



KisselKar Six-Cylinder Combination Chemical and Hose Wagon Recently Delivered to Fire Department in Quincy, Mass.

ple, San Francisco now has in service a special double 80-gallon tank chemical and a hose wagon designed to move a heavy cargo of water hose and squad of 10 men. A six-cylinder touring car also is used by Assistant Chief Maxwell and four roadsters have recently been put into commission by the battalion chiefs. These machines are all Pope-Hartfords, made by the Pope Manufacturing Company, Hartford, Conn.

Fire Chief Murphy, in speaking of his experience with the motor driven vehicles, says: "We are going to motorize the whole department as soon as we can, so satisfactory has been the service we have had from the motors we now use and I expect to be able to do better with less pieces, proportionately, in the future, because of the fact that they are motor driven. We will get more service than we could with the horse drawn apparatus. In respect to speed in getting to a fire, ease of handling cars in crowded streets, ability to stop quickly, and in fact general all around efficiency,



Six-Cylinder Lozier Chassis Mounted with Patrol and Ambulance Body for Police Department in Augusta, Ga.

motor fire pieces I have found to be far ahead of the old style of horse drawn fire fighting machine. Although San Francisco's streets during the past few years have been in a more or less torn up condition on account of the laying of new water and sewer mains, the hauling of immense quantities of building material and general street rebuilding, the fire motors have stood up under this strain in splendid shape and have given right along the very best service possible."

AUGUSTA POLICE PATROL.

Six-Cylinder Lozier Chassis Mounted with Combination Body for Southern City.

The police department in Augusta, Ga., recently took delivery of the Lozier patrol and ambulance shown in an accompanying illustration. The chassis is fitted with a six-cylinder motor and is the product of the Lozier Motor Company, Detroit.

The latter is of new design, and is arranged to accommodate 10 persons beside the driver and attendant. The appointments are thoroughly in keeping with the work the machine will be called upon to perform, and are modern in every particular. These include a stretcher and other first aid apparatus, so that the vehicle always is available for ambulance purposes at an instant's notice.

WATERBURY COMPARING COSTS.

Experience with Motor Fire Apparatus Such as to Convince Mayor of Its Economy.

Attention has been directed to the conservative estimate of Mayor F. T. Reeves of Waterbury, Conn., concerning the saving to be effected by the substitution of automobile fire apparatus in place of horse drawn vehicles. The mayor figures the difference in the cost of upkeep, which he says will pay the interest on a bond issue and wipe out the principal in 25 years. However, analyzing further it is found that there are other factors which make a much larger total. Each horse drawn apparatus requires one man to remain constantly with it to attend to the horses. Thus each horse vehicle costs $1000 a year for the man to guard it, while the motor apparatus can be left alone at any time and the city is saved an annual amount of $1000, which in 10 years would be more than enough to replace the apparatus should it become worn out.

The motor combination pump and hose wagon, which replaced two horse drawn pieces of apparatus at Waterbury, released two $1000 drivers for fire duty. A horse equipped engine company, when the engine is not pumping, holds three men in idleness, two drivers and the engineer. When it is pumping it draws an additional man from active duty to stoke the engine. When a motor engine is not pumping its whole crew is at work. When it is pumping it requires the services of one man only. This means an annual saving on a single piece of apparatus of a trifle over $3000 in salaries alone. Admitting, as has been claimed, that the life of motor apparatus will not be over 10 years, the total saving, $30,000, would replace the machine three times and still leave $3000 extra to be applied to the bond sinking fund. These figures are significant as showing the experience of a city that has already tried the motor fire apparatus with such success financially and otherwise, and that measures are being considered for a further investment of the same character.

BRIEF ITEMS FROM SEVERAL CITIES.

Cincinnati Buys Ten Combinations—One of the largest contracts made in many months for fire fighting machines of the automobile type was closed recently by the officials of Cincinnati, O., with the Ahrens-Fox Fire Engine Company of that city. By its terms the firm will furnish Cincinnati with 10 combination chemical and hose wagons to be delivered within 90 days.

Cleveland Adopts Electric Pumps—Going a step farther than most cities in their aims to introduce automobile fire fighting apparatus on a large scale, the authorities at Cleveland, O., are engaged on a plan for an electric pumping system patterned somewhat after that used at Berlin, Germany. Electrical connecting plugs are to be established beside the water plugs so that current for operation of the pumps may be obtained directly. These pumps are to be mounted on automobile chassis and to have a capacity for throwing 1000 gallons of water a minute.

Tampa Experimenting with Hudson—Tampa, Fla., has purchased a six-cylinder Hudson car, made by the Hudson Motor Car Company, Detroit, for Chief W. M. Mathews of the fire department. The machine is equipped with chemical extinguishers and other apparatus and carries five men, who often find it possible, because of the speed in getting to fires, to check them in their incipient stages. The success of the experiment may lead to further motorization of the department.

Gasoline Trucks for Electrical Department—The electrical committee of the board of bond trustees of Jacksonville, Fla., recently let the contract for furnishing complete three five-ton trucks for the electrical department of the city, to the International Motor Company of New York City, maker of the Saurer. The contract for furnishing an automobile for the use of the superintendent of underground construction was awarded to L. C. Oliver, who agreed to furnish a Ford touring car, made by the Ford Motor Company, Detroit, completely equipped.

KisselKar Reduces Fire Loss—The decrease in property loss since the general introduction of motor fire apparatus is noted by a report of the fire chief of Kankakee, Ill., who states that since his department placed in service a KisselKar hose and chemical wagon, made by the Kissel Motor Car Company, Hartford, Wis., the total loss in 57 fires has been only about $2500.

Hartford to Replace Horses—Realizing the need of motorizing all the fire apparatus in the city, the fire commissioners of Hartford, Conn., recently held a conference with the officials of the Pope Manufacturing Company of Hartford, maker of Pope-Hartford fire vehicles, and it was practically decided that an estimate would be included in the budget for this purpose. It is planned to put all the engines now in use on heavy chassis. The new tractor engine purchased from the American-La France Fire Engine Company, Elmira, N. Y., and recently tested, was accepted.

New Haven Shows Good Record—Figures compiled by the officials of the fire department in New Haven, Conn., indicate that the loss from fire during 1912 was only a trifle more than one-half that for 1911. These figures prove the advantages of automobile fire fighting apparatus. The loss in 1911 was $487,179 and in 1912 was $288,077. Speaking of this showing Chief Fancher said: "It highly pleases me that the fire loss this year is much lower than in 1911. This was accomplished by the motor wagons of the department and mostly by the squad wagon at Olive street, which has reached hundreds of fires in outlying parts of the city before any other piece of apparatus."

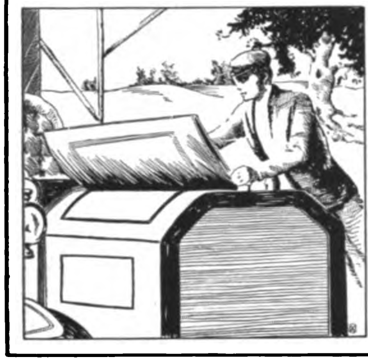
Mora Wagons for City Service—Recently the Mora Power Wagon Company, Cleveland, O., installed a Mora wagon of the open express type and 1500 pounds capacity, in the water works department in that city. Another vehicle of similar type was delivered to the city of Youngstown, O., where it is doing good work as a service wagon in the fire department.

Buicks for Boston Departments—The Buick Boston Company, distributor of Buick cars, made by the Buick Motor Company, Flint, Mich., has secured orders for roadsters from the Boston board of health, fire and wire departments. The fire department is especially well qualified to pass upon the merits of the Buick, as it has one model that has been driven over 100,000 miles and is in such condition today that an offer by the company to take the car over when the new one was ordered was refused by the city officials.

Second Knox for Lynn—The city of Lynn, Mass., which has had a Knox ambulance in its police service for several years, has just received another such vehicle from the Knox Automobile Company, Springfield, Mass. The machine embodies numerous improvements over the earlier models and the police officials are pleased with the service it is giving.

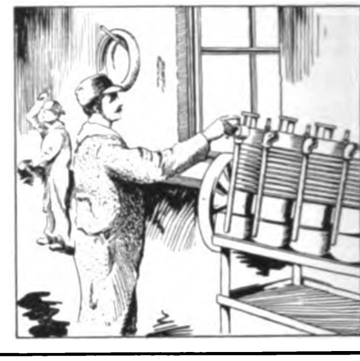
San Jose Buys a Knox—Samuel Crim, head of the Reliance Automobile Company, San Francisco, Cal., distributor for Knox vehicles, made by the Knox Automobile Company, Springfield, Mass., has received notice that a bid submitted by him to provide the city of San Jose, Cal., with a Knox combination chemical and hose wagon, has been accepted.

Garbage Wagons in Salem—Commissioner Edwards of Salem, Mass., who has charge of the street cleaning department, will request the aldermen to make an appropriation for 25 motor trucks to be used as garbage wagons, to take the place of the horse drawn vehicles now in use.



HINTS·FOR·PROPER MAINTENANCE

A Department for the Owner, Driver and Repairman.



CARLTON ALL-FUEL CARBURETOR.

The increasing cost of gasoline has resulted in more attention being given to heavy fuel carburetors, particularly abroad. A vaporizer which is of interest because of its small size and the utilization of a double-disc baffle plate member, is the Carlton all-fuel carburetor, an English design shown at Fig. 1. It is held that gasoline, benzol or kerosene may be vaporized successfully, although starting is not possible with the heavier fuel without resorting to heating.

As will be noted by the drawing, the vaporizer is of the valve controlled type and the principle of operation is said to be such that the several fuels may be employed successively without any alteration or adjustment, and with a clean exhaust.

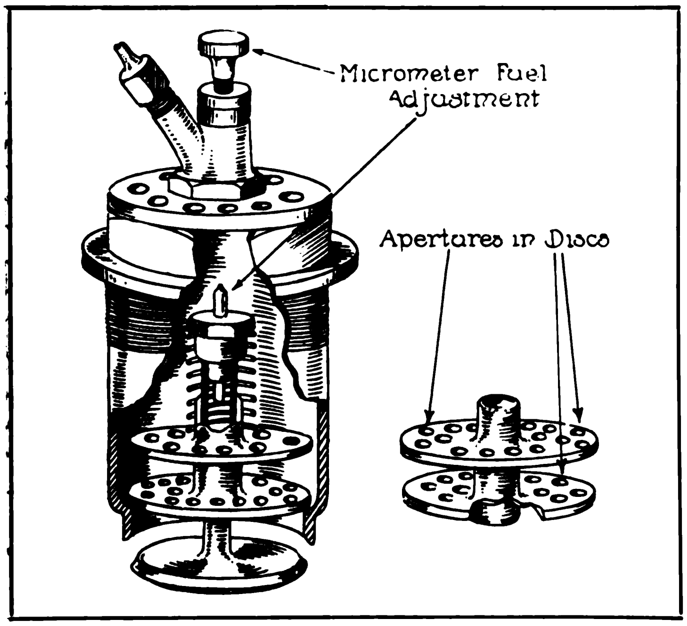


Fig. 1—The Carlton All-Fuel Carburetor, a Diminutive Valve Type of Vaporizer Having Double Discs.

The feed may be regulated by a screw arrangement and it will be noted that the needle, which is spring mounted in the top of the induction valve itself, sets directly into the bottom orifice of the fuel pipe. The feed arrangement is therefore extremely simple, and as ample means for adjustment are provided, there is practically nothing to do after the first setting.

One of the interesting features of the carburetor is the double-disc baffle plate, in which a large number of holes are so drilled relatively as to be in no sense opposite each other. This results, it is stated, in a high degree of atomization of the fuel as it is drawn past the discs and onward into the induction pipe.

HOME MADE VALVE LIFTER.

The average workman has in his tool kit a valve lifter which he prizes, in that it is suitable for the majority of motors. Occasionally, however, it will be found that the regular tool will perform the work easily. A simple form of tool for compressing the valve springs is shown at Fig. 2 A. It is a common type, but as it is constructed easily it may be of service to some repairman who encounters a motor not adapted to the regular lifter. It will be noted that the fulcrum member is provided with a number of holes for adjusting the lever to varying heights of the cylinders. The retaining bolt is threaded at one end to take a wing nut. The material can usually be secured from the scrap heap.

PISTON RING CLAMP.

Replacing the cylinder over the piston is sometimes a difficult task, although simple enough when the operator has an assistant to compress the rings. An easily made clamp and one which will enable the workman to replace the cylinders without help, is depicted at Fig. 2 D and E. It is made of sheet metal, rolled to the form shown at D and provided with two wings or extensions to take a threaded bolt carrying a wing nut. The clamp is slipped over the piston and rings, and the nut screwed up, compressing the rings into place. The cylinder is then slid over the piston, and the tension of the clamp relieved. As the cylinder moves downward it will slide the clamp along. The piston and rings should be well lubricated before the clamp is affixed to prevent binding or injury.

RENEWING TEETH IN FIBRE WHEEL.

A driver who cares for his machine had the misfortune to have two teeth of a fibre timing gear strip through a small piece of metal getting between them when the engine was operating. Not wishing to lay the machine up while awaiting a new gear, a repair

was successfully made in the following manner:

A piece of square fibre slightly wider than the thickness of the wheel was secured and the latter sawed as shown at Fig. 2 B, the surface being smoothed up with a file. The block was then cut to make a driving fit after which a template was made from the good teeth, for marking off the required members on the insertion. These were cut with a hacksaw, smoothed and trued with a file, after which two circular brass plates were turned up and placed in position as shown at C. The plates were then secured by rivets.

MORGAN TOOL HOLDER.

A handy tool holder, combining as it does the functions of a number of similar devices, is the Morgan, manufactured by B. Morgan, Newport, R. I., and shown at Fig. 2 F. It is made in three sizes, constructed from hardened steel, carefully machined, and the tool post will hold securely round, flat, square, hexagon and shaped tools from the largest size to a No. 60 drill. The two machined parts are held together by a slotted link, keeping them parallel with respect to side motion, but allowing the two parts of the holder to swing around to a straight line and to reverse their position.

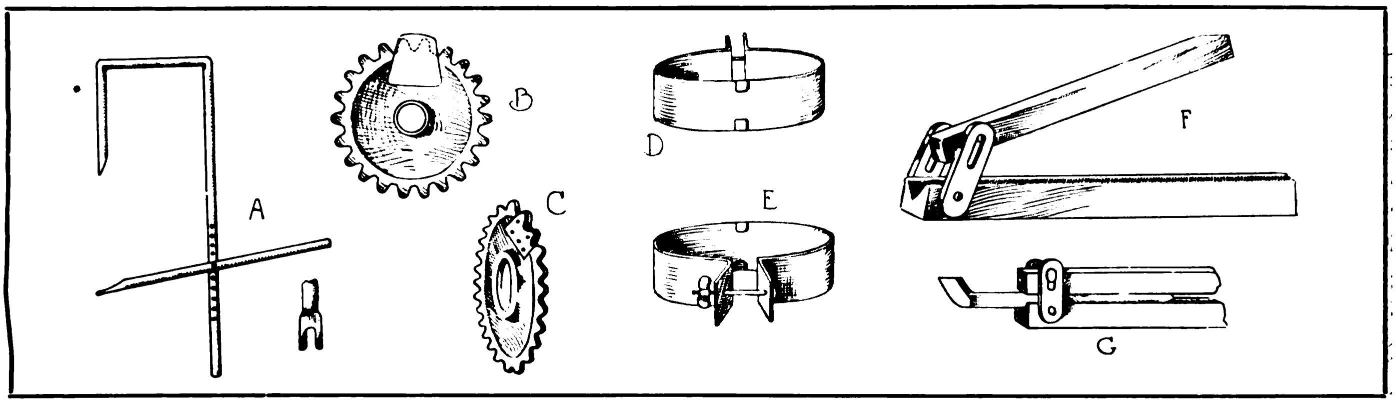


Fig. 2—Useful Tools for the Repair Shop: A, Easily Constructed Valve Lifter; B and C, Method of Replacing Broken Teeth in Fibre Gear; D and E, Piston Ring Holder; F, Morgan Tool Holder; G, Holding a Diamond Point Tool.

The heavy portion of the holder has a deep V slot on one side and a hair line on the opposite, while the smaller or lighter bar has a V slot on one side and is plain on the other. The V slot in the lighter portion registers with the deep V slot in the heavy section, which enables large tools to be held. When the tool is reversed the small or hair line slot has a plain or blank bar opposed to it, enabling the clamping of the lightest drills. A complete set of tools is manufactured, there being 11 in all, and the sizes vary according to the equipment. At G is shown the holder on the square and with a diamond point inserted.

LIGHTING THE WASHSTAND.

The very general adoption of the mechanical transport by florists, undertakers, department stores, etc., has resulted in a number of elaborate bodies which are nicely finished. This means that the garage or service station caring for these cars must provide excellent service in the matter of washing and polishing. A proprietor of a garage who caters to a nice clientele has devised the lighting panel shown at Fig. 3 and as a result the washer is not only sure of good illumination, but cannot make excuses for poor work.

The panel was constructed easily, the material being two smooth boards about five feet long, six or seven inches wide and .625-inch thick, although these dimensions may be altered to suit convenience of stock and location. The boards were joined as indicated at B. Lamp sockets were attached and wired and the interior of the panel given several coats of white enamel paint, which formed a good reflector.

Two panels were made, one for either side of the space occupied by the machine, and fitted with suitable rope and pulleys so that they could be raised and lowered as desired. Being adjustable the washer is able to have good light for the running gear as well as body.

At C is presented a suggestion for a light stand. It comprises an old music rack, having an adjustable rod to which is secured a reflector which could be of such size as to permit of the use of three or four lamps. The rack could be mounted upon a wooden base and with sufficient length of flexible cord and a connecting plug, the stand could be moved to any desired position. Such a device would prove of service when working on the chassis in the overhaul.

ALLEN FRICTION WRENCH SET.

A tool that presents interesting features which will appeal to the repairman as well as driver caring for his own machine, is the Allen friction socket wrench. It is not a ratchet tool and its grip is secured through a patented application of the friction principle. An instantaneous grip is secured without lost motion, making the device particularly adaptable for removing and replacing nuts or bolts where the space is very limited. The tool is practically a solid member when assembled and is reversible.

The maker lays great emphasis upon the high grade material and workmanship and the wrench is a drop forging of high point carbon steel, carefully machined, pack hardened and finished. All moving parts of the

friction member are ground accurately and the limit is exceedingly fine. Three sizes are manufactured, the No. 31 set being shown at Fig. 4. This comprises in addition to the wrench, 31 steel sockets varying by thirty-seconds from .3125 to 1.28125 inches. These are of high grade steel and each is heat treated and case hardened. Two extensions are provided, a short and long member, the latter being 9.5 inches, also a universal joint. This is constructed in a substantial manner and designed for hard service.

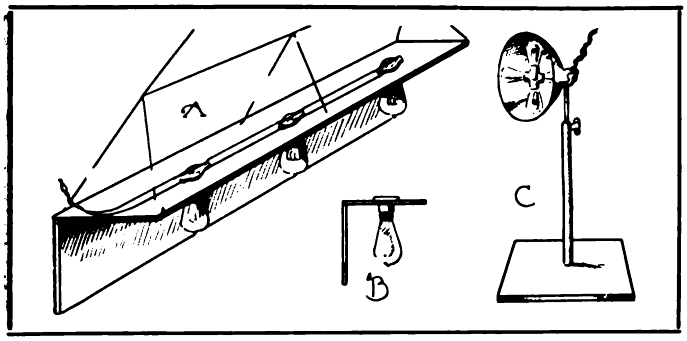


Fig. 3—Easily Constructed Lighting Devices for the Washstand: A, Panel and Method of Suspension; B, End View; C, Adjustable Stand Constructed from Music Rack.

There are also three square sockets, these being .40625, .53125, .65625 inch, respectively. A screw driver and spark plug wrench are included as well. The outfit comes in a neat box and is moderately priced. The maker, the Allen Wrench & Tool Company, 4 Meadow street, Providence, R. I., manufactures different sized outfits to meet individual requirements. A drill attachment is being produced by the company.

HEATING DUE TO CIRCULATION.

Heating of the motor may be due to a number of causes such as too rich a mixture, loose fan belt, retarded spark, timing, etc. An instance of an engine heating after an amateur overhaul was noted by the writer recently. The driver was puzzled to account for the trouble and although the pump appeared to work properly, the motor became hot after running a short time.

It developed that in the overhaul the operator had not given any attention other than fitting new gaskets to the water connections and admitted that he had not looked over the pump as it was working properly before the overhaul. Upon taking the member off the power plant it was found that it was fitted with a screen and that the meshes had become clogged with sediment. When cleaned and replaced the cylinders were normal even after running the motor for some time. In connection with this work the novice cannot be too careful to note that the openings of the gaskets correspond with those of the piping and cylinders when these members are in position.

PROPER HEAT FOR ANNEALING.

The proper temperature for annealing is almost a forging heat. Keep at a bright red long enough to overcome all strains which may have a tendency to manifest themselves during the hardening process. It is not good practise to use cast iron chips or turnings for packing, as they will decarbonize the steel to such an extent as to prevent successful hardening afterward. Packing parts too near the walls of the annealing box will have almost the same result as the chips; in fact, it will be worse, as the decarbonization will be unequal and the surfaces nearest the box sides will be affected, thus making uneven whatever hardening is possible.

Shops that have not the facilities to allow of using the above described annealing process, may obtain satisfactory results by heating the steel in a charcoal fire to about an even forging heat. Then put a few inches of the fire ash in a box and on top of the ash place a soft pine board, over which the heated work is laid and the box covered. The wood will char and smoulder and the steel will remain hot for a considerable period. A box of cold ashes may be utilized to accomplish the same results to a less extent, as the cold ashes and lime are apt to chill the steel. However, when either of the materials is used hot, good results will be obtained.

A SOLDERING TIP.

In working with soft solder and using rosin for flux to give a nice appearance, the melted rosin may be removed with a cloth moistened with benzole.

CUTTING SQUARE THREADS.

A lathe kink for cutting square threads is as follows: With an ordinary V shaped cutter, form a thread of the proper lead that will be equal in depth and width to the cut of the finished square. Then follow down with the regular square tool. This saves the latter, which cuts a square or broken chip. A roughing member should be used before cutting. If more than one piece is to be threaded, rough first and then finish, as this will keep the tool sharp and result in a nice finish. The rougher should be speeded up and allowed to dig out the metal without regard to finish.

Fig. 4—The Allen Friction Wrench Set, the Wrench Proper Operating on the Friction Principle.

CORRESPONDENCE WITH THE READER.

Acetylene for Starting.

(25)—Can a motor be started with acetylene gas from a generator? I read somewhere of a driver who claimed to have detached the tube from the lamps and led it to the air intake of the carburetor. Is it practical? M. W.
Garden City, N. Y., Jan. 15.

A motor may be started with acetylene when combined with proper proportions of air to make an explosive mixture. There are several motor starters on the market employing acetylene which is combined with air by a regulating valve or mixer. The writer has never seen a cold motor started in the manner mentioned, but has been informed that acetylene gas led to the intake manifold aids in starting.

Lead of Magneto.

(26)—Having converted a pleasure vehicle into a truck and secured a Bosch magneto with variable advance would be pleased to receive information as to installation. Do you install it the same as a timer and set it the same, or do you time it earlier? How do you figure out the advance in proportion to the size of motor? CONVERT.
Trenton, N. J., Jan. 5.

The drive, direction of rotation and speed are factors to be considered. The magneto must be driven in the same direction as marked on the instrument and this is determined by looking at the shaft end, that part of the shaft to which the gear or driving member is to be attached. Magnetos are driven either clockwise or anti-clockwise, usually in the former direction. When fitted to single, two and four-cylinder, four-cycle motors, the magneto must be driven at crankshaft speed.

The drive should be positive, by shaft or gears when possible as chain, unless of the silent type, enclosed and running in oil, does not give satisfactory service. An exposed chain will wear and affect the timing. Another factor to be considered in chain drive is the stress upon the armature bearings. If provision is not made for mounting a magneto, it is possible that the crankcase can be cut into and a gear drive secured. This will necessitate the making of a pattern to enclose the parts.

As to timing, the magneto is usually installed so that the contact points of the breaker box open at a certain point, corresponding to a predetermined angularity of the crank throw from vertical, the relation of the piston travel to the rotation of the crankshaft depending upon the stroke and the length of the connecting rod.

It is a simple matter to ascertain the piston travel in inches by inserting a wire or small rod through an open petcock. It is not so easy, however, to determine accurately the rotation of the crankshaft, and to obviate the necessity of lengthy computations the diagram presented at Fig. 5 was compiled by the Bosch Magneto Company, New York City. With this it is a simple matter to determine the angularity of the crank throw from vertical, provided the stroke and piston travel in inches are known.

In the diagram the relation between the piston travel and the connecting rod length is 1:4.5. The vertical lines numbered at the bottom give the stroke of the motor in inches, the rotation of the crankshaft in degrees being indicated by the slanting lines and the figures at the right. The figures on the left and the horizontal lines indicate the piston travel in inches.

To illustrate the use of the diagram: Let it be assumed that it is desired to find the piston travel for an advance of 30 degrees on a motor having a six-inch stroke. The vertical line for the desired stroke may be identified by the figures at the bottom of the diagram, and this vertical line is followed until it cuts the diagonal line indicating the desired number of degrees, which is 30 in the present case. The horizontal line nearest this point is followed to the left, and in the illustration it will be noted that it indicates about .5 inch. This figure denotes the advance in inches cor-

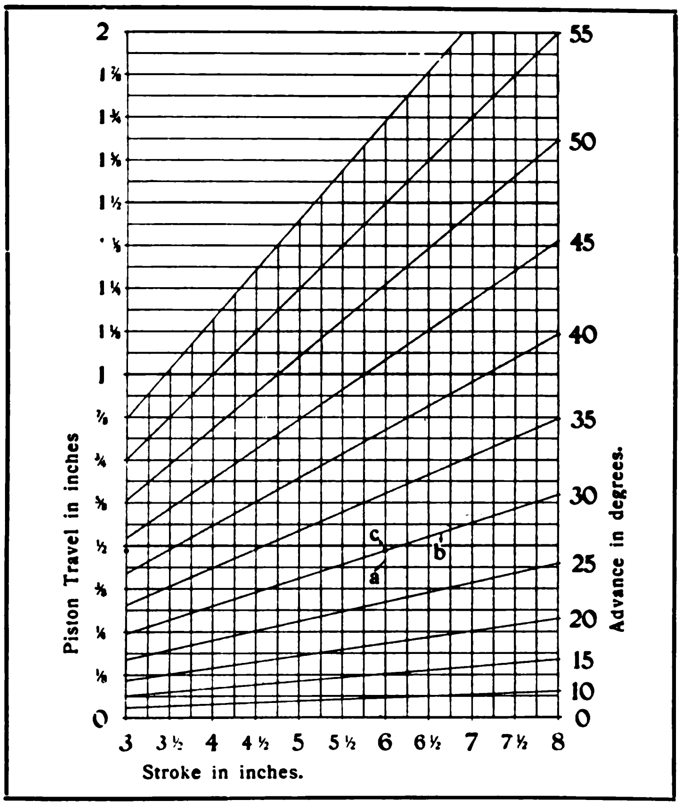


Fig. 5—Bosch Timing Diagram for Ascertaining the Angularity of the Crank Throw from Vertical When the Stroke and Piston Travel Are Known.

responding to a rotation of 30 degrees of the crankshaft.

Consequently in setting a magneto on an engine having a stroke of six inches, it will only be necessary to insert a wire in the opening of the petcock of the proper cylinder, the first, for example, and turn the flywheel backward past dead centre until the piston has descended about .5 inch. This will correspond approximately to a rotation of 30 degrees of the crankshaft.

The type of magneto was not mentioned, but in connecting the leads to the distributor, the firing order of the motor must be considered as when timing by the usual commutator. The Bosch Magneto Company, 225 West 46th street, New York City, will forward complete information upon request. The type of magneto should be mentioned in the communication.

FOREIGN TRUCK NOTES OF INTEREST

RUSSIA BUYS SAURERS.

Large Order to Be Filled by Switzerland Maker Includes Repair Shop on Wheels.

The Russian government has ordered 76 motor trucks for army use of the Arbon factory at Arbon, Switzerland, of which Hippolyt Saurer is the head. Among the types being furnished are a heavy ambulance, convertible or duplex truck, the body of which is so arranged that it could carry aeroplanes or seats as desired, and a series of vehicles to make up a new unit of warfare, called by the Russians an "escadrille," which also has intimate connection with aviation. This unit is made up of two touring cars, three material trucks and one "factory" truck.

Each of these machines tows a trailer of unusual length, upon which an aeroplane is carried, a total of 18 pieces for each of the units. "Indications are," says Mr. Saurer, who recently paid a visit to the United States, "that this new branch of the service is looked upon as a useful addition to the war strength of the army. The so-called factory truck is a veritable factory on wheels, having a complete machine shop, equipped for not only making minor repairs, but also to do heavy and major replacements and refittings.

INTERESTING SCOTCH PRODUCT.

Albion Trucks Utilize Gasoline or Kerosene Carburetor at Purchaser's Option.

One of the oldest concerns engaged in the production of commercial motor vehicles in Great Britain is the Albion Motor Car Company, Ltd., Scotstoun, Glasgow, Scotland. The Albion is made in three types of chassis, fitted with 15, 16 and 32 horsepower motors, respectively. That illustrated herewith is the largest.

The motor is a four-cylinder unit with bore of 4.5 inches and stroke of five. The inlet and exhaust valves are mechanically operated, and the camshaft and governor gear wheels are enclosed. Relief cams fitted to the camshafts are designed to make easy the reduction of the compression and the starting of the engine. Lubrication is by a patented system of force feed. Ignition is by high-tension magneto, driven through the Albion patented flexible coupling.

The clutch is a single disc type. The transmission gives three forward speeds and reverse. Forward speeds are operated by positive clutches, the gears always being in mesh, while the reverse is obtained by sliding gears. Two sets of brakes are fitted. Standard wheels are of cast steel, and for colonial work steel tires are fitted if desired.

Contractor's Tipping Body Installed on Three-Ton Albion Chassis for Use on Island of Trinidad.

The machine illustrated was constructed for a government contractor on the island of Trinidad, and for such countries the company supplies a kerosene carburetor upon option. The general principle upon which this vaporizer operates is that the fuel is fed by the usual type of float chamber to a jet and is atomized by the inrushing air. Only a small proportion of the air is taken over the jet, and the rich mixture of air and atomized kerosene is immediately conducted to a chamber having a very large corrugated heated surface, the heating being accomplished by the exhaust gases. The rich gas from this chamber is led to a double-beat mixing valve controlled by the governor, which in conjunction with the speed air valve is held to permit under all conditions of load and speed the correct amount of additional air to enter with the rich vapor to insure the most efficient and economical mixture reaching the engine. This matter of kerosene carburetion is meeting with general interest in cost of gasoline and the success of the Albion is such as to indicate its possibilties.

Several standard types of bodies are supplied by the Albion company, these being suited to the various requirements of the individual purchaser. The tipping body shown has met with decided favor. It is constructed to carry a load of three tons. The tipping mechanism is operated by the motor, a winding drum being fitted at slight extra expense if specified at the time the vehicle is ordered.

BELSIZE DELIVERY VAN.

Type of Light Weight Vehicle That Is Proving Very Popular in England.

An accompanying illustration shows one of the 1500-pound Belsize delivery vans delivered recently to the Leicester Co-Operative Society, Ltd., Leicester, England. The car is made by the Belsize Motors, Ltd., Manchester, England, and is proving decidedly popular with a number of merchants and others in Great Britain.

The motor is a four-cylinder, vertical unit of the L head type, with bore of 3.6875 inches and stroke of 4.75. Inlet and exhaust valves are interchangeable and are mechanically operated. Lubrication is automatic. Cooling is by thermo-syphon with large water manifolds. The radiator is of the honeycomb type, and cooling is further aided by a powerful fan. Ignition is by high-tension Bosch magneto.

The clutch is a cone member, metal to metal, and the transmission gives four forward speeds and reverse, high speed being direct. The service brake acts on drums on the rear wheels, while the emergency member is on the jackshaft. Both are of the internal expanding type, metal to metal, and double acting.

The frame is of pressed steel of deep section. The front axle is a section forging fitted with ball bearing hubs and pneumatic tires are utilized on the forward wheels. The rear axle is of the live axle type, and solid tires are fitted to the rear wheels. The equipment includes a full set of tools and provision is made for the carrying of one extra pneumatic shoe.

The standard body is an enclosed van type, although the details are worked out to meet the special requirements of the purchaser. Open bodies also may be had. The design is intended as a light, strong vehicle which shall be capable of carrying medium loads, from 1500 to 2000 pounds, and making quick runs. The use of both pneumatic and solid tires is considered a decided advantage in the matter of maintenance cost.

Belsize Light Delivery Van of 1500 Pounds Capacity Utilizing Pneumatic Tires on Front Wheels and Solids on Rear.

BRITISH ENGINEERS COMING.

Accept Invitation Extended by American Society and Programme Is Now Being Formulated.

The council of the Institution of Automobile Engineers, London, Eng., devoted the last meeting early in January to the reading of a paper on "The Training of an Automobile Engineer," which was prepared by four of the graduates of the London section. The council considers that the matter is of extreme importance and will lead to a keen discussion.

The preparation of the programme for the visit to the United States is progressing and members will probably leave London, May 17, returning about June 24. The American Society of Automobile Engineers has extended its invitation to include the members of the Society of Motor Manufacturers & Traders, Ltd., so that the delegation to America will be considerably augmented.

The itinerary prepared by the American engineers includes visits to nearly all the leading manufacturing centres of the industry, the speedway races at Indianapolis and a three days' trip on the Great Lakes in connection with the summer meeting of the Society of Automobile Engineers. For this purpose the largest vessel on the lakes has been chartered for the exclusive use of the party. The journey through the states will be made in special cars.

ADDITIONAL NEWS FROM ABROAD.

Plowing Contest in Russia—In connection with the automobile exhibition to be held at St. Petersburg in May, under the direction of the Imperial Russian Automobile Club, it has been decided to inaugurate a competition for motor plowing machines.

Ambulance for Bulgarian Army—The Daimler Motoren Gesellschaft of Unterturkheim, Germany, is reported from Berlin to have secured an order from the Bulgarian military authorities for a 20 horsepower motor ambulance.

British Maker Adopts Installment Plan—In order to encourage the use of motor tractors and assist the farmers who desire such service in the United Kingdom, the Ivel Agricultural Motors, Ltd., has made arrangements whereby it is prepared to supply its latest type of machines on terms by which payment can be extended over a year. By this system the price is fixed at 3 per cent. higher than the cash terms. The plan also is suggested by other makers to meet competition arising from the so-called American invasion.

Plans for New Zealand Show—A special feature of the industrial exhibition to be held at Auckland, New Zealand, in 1913-1914, will be the exhibit of all kinds of motor vehicles. The event will be opened Dec. 1, 1913, and will be closed about the end of February, 1914. The proposed building provides 120,000 square feet of space and this will be increased as required. This exhibition will doubtless be of decided importance to manufacturers of industrial motor vehicles as the interest in the mechanical transport is rapidly increasing in New Zealand.

Japan Orders Army Transports—Following the example of all the large European nations, Japan, through its war department, has ordered a number of motor trucks for army service and announces a subsidy system which will encourage the use of such vehicles by individuals and business houses, the same being available for army transport in case of war.

No Trucks at Scottish Show—At the last meeting of the Society of Motor Manufacturers & Traders of Scotland, Mr. Matthew reported that the proposed Scottish show of industrial motor vehicles had been abandoned and that no business vehicles would be shown at the next motor exhibition at Edinburgh.

Canadian Company Adopts Electrics—The Canadian Express Company is the first concern of its kind to operate motor trucks in Canada and recently put in service a fleet of electric vehicles in Montreal and Toronto. John Pullen, president of the company, states that the experiment is being tried to secure the highest efficiency in accordance with commercial economy. If the results hoped for can be obtained with the electrics the horses and large stables gradually will be eliminated. It is planned to use the electrics all the year round at Toronto, while in Montreal, where the severe northern winters offer less advantageous climatic conditions, it is expected they can be used at least seven months in the year. The express company is installing its own charging stations and this work will be done at night.

Germany's Postal Vehicles—According to the statistics of the German postal authorities the number of government owned and rented motor wagons used for mail service is 52, 39 of these being owned and 13 rented. This does not include the wagons used on 16 routes for both postal and private purposes. Of the 52 vehicles, 12 omnibuses, mostly of 10 seats, are used for transporting letters, parcels and persons; 25 wagons, resembling the ordinary express motor wagon, for letters and parcels only, and the others are small three and four-wheel machines used for collecting regular mail, special delivery, etc. The wagons are partly electric and partly gasoline. In consideration of the favorable results obtained with the electric vehicles, the government has ordered 25 more of this type. The question of superiority in postal transportation is now removed from the stage of experimentation and has been decided in favor of the power wagon.

Tractors Aid Canadian Farmers—It is stated that the difficulty of securing farm labor in Canada is directing more and more attention to the use of the motor tractor for farm work. The experience of the farmer is that it requires fewer men and less attention than horses. It is estimated that at the present there are in the three prairie provinces about 6500 motor tractors and notwithstanding a wet season each of these has made at least 60 days of work in breaking new sod. The average acreage ploughed daily by each tractor is placed at 10, which means that about 3,900,000 acres of new land has been broken for the 1913 crop.

British Parcel Post Service—An excellent motor parcel service is being developed at East Lancashire, England. A motor truck, said to be the largest up-todate parcels van in service, has been running recently to Preston and Chorley through St. Annes and Lytham and the service has been extended to Liverpool and Manchester. The Blackpool van leaves at 7:05 in the evening every day and travelling by the coast route to Preston and thence by way of Bolton and Bury, reaches Manchester soon after midnight. The return journey is begun about an hour later and Blackpool is reached again soon after 6 in the morning, ready to send out parcels by the first delivery. Parcels for Warrington and Liverpool are transferred to another van at Chorley. The Blackpool van covers 111 miles every night.

To Garage Mail Wagons—The big garage built at Toronto, Can., for the Imperial Motor Company has been sold to the Canadian government for $80,000 and is being used to house the royal mail cars. These cars handled the British Christmas mails with expedition. The six mail wagons are to be stored on the ground floor of the garage and another part of the building is used as a storeroom for postoffice supplies. A repair shop is located on the top floor.

New Traffic in Denmark—A decision was recently given by the Danish customs authorities to the effect that motor fire engines of all kinds imported into the country are to be classified under No. 167 of the tariff, the duty being 5 per cent. ad valorem.

THE A B C OF MOTOR TRUCK IGNITION.

Part VI—Outlining the Various Systems Utilized with the Commercial Gasoline Vehicle, Their Components and Application in Practise—Describing Function of Spark Plug and Method of Timing the Spark—Wiring Plans Discussed.

THERE are two methods of electrically igniting the mixture or gas in the cylinder, one of which employs a low-tension current or the make-and-break system, while in the other the induced or high-tension current jumps between the two points of the spark plug, which gap or space breaks the continuity of the secondary circuit. The former method comprises an igniter plate, mechanically operated, and this system will be taken up and described in its logical sequence.

The jump spark plug is a very simple device and there is, perhaps, no other component of the motor car which is represented by so many different makes. The principle of operation is similar with each and a general description of the device will serve. It consists of two terminal electrodes separated from each other at the points within the cylinder by an air space, and at other portions by means of suitable insulation.

Construction of Spark Plug.

By referring to Fig. 26, which depicts two conventional methods of construction, the arrangement of the various parts will be noted. It will be seen that one terminal or point is integral with the shell, which also is of metal. The other electrode runs vertically through an insulating material in the centre and this insulation may be porcelain, mica or some similar substance through which electricity cannot pass. The shell is threaded for screwing into the cylinder and when the plug is fitted the gap section extends into and comes in contact with the explosive vapor.

It has been explained that a path must be completed before electricity can flow and that the metal of the motor or frame provides one side of the circuit because one lead from the source of current is attached to the frame or other metal part. The shell of the plug being of metal and screwed into the cylinder makes it a part of the ground side of the circuit, or the return path as it may be termed for the purpose of explanation.

Operation of Plug.

In the previous installment it was shown that the high-tension current was led to the spark plug terminal by means of a very heavily insulated wiring. Assuming that the terminal of the cable from the coil, where the low-tension current has been converted into a high-tension, is attached to the terminal member on the top of the spark plug, the former being of metal and in contact with the metal electrode extending through the porcelain or insulated material, the current will flow until it reaches the air gap. At this point resistance is encountered, but if the vibrator of the coil be adjusted properly and the current be of sufficient strength, the electricity will jump across the gap to the other terminal in its effort to return by the way of the shell, cylinder, frame, etc., to the battery, thus completing its circuit.

Porcelain and mica are most commonly utilized, although stone and lava are employed for insulating material in high grade plugs. By referring once more to Fig. 26 it will be noted that A presents the porcelain design and B the mica. It will also be seen that the insulating material of the former is thickest in the centre and that the shoulders conform in shape to a recess in the shell. Between the porcelain and metal is inserted a copper and asbestos gasket which serves two purposes, one being to provide for the expansion of the porcelain and metal when heated and the other to prevent the escape of any of the compressed mixture or burnt gases.

In assembling the parts of the plug, the washer member rests against the shoulder of the shell and the

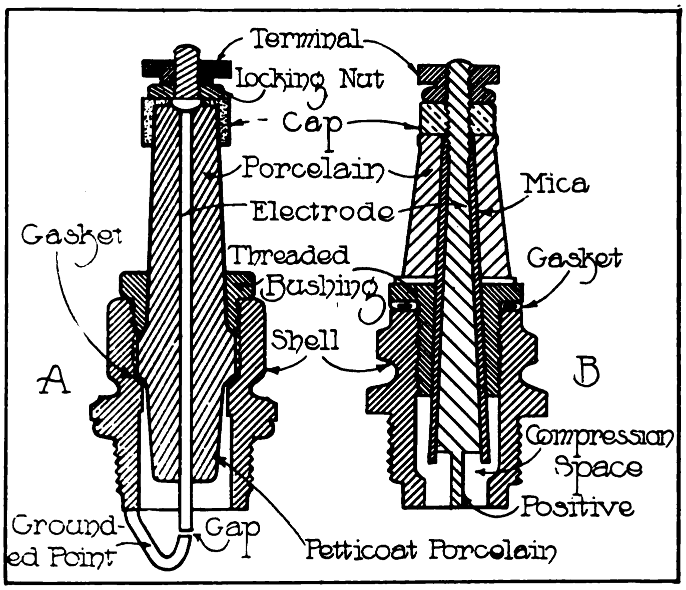


Fig. 26—Illustrating the Construction of and Components of Spark Plugs: A, Porcelain Type; B, Showing Insulating Material of Mica.

porcelain is held securely against it by a threaded bushing which when screwed down compresses the washer, making a perfectly gas tight joint. Copper and asbestos combinations are not always utilized. The washer may be asbestos or other similar suitable material.

It is important that the metal vertical electrode be fitted properly so as not to permit of the passage of gas, etc., and usually the top of the porcelain is protected by a metal cap which is retained by a nut. Another terminal member is fitted for the purpose of securing the terminal of the secondary wire.

Mica Spark Plugs.

At B is shown a conventional construction of a mica plug. In this particular type the electrode is sur-

rounded by a high grade of mica and two layers of the material are usually employed. Over the mica is placed a porcelain shell. As previously explained the insulating material may be of lava, stone, etc., and although many plugs are so designed that they may be disassembled for cleaning purposes, some makers utilize a construction in which the insulation is practically integral with the shell. With this form it is held that there is no possible opportunity for leakage.

That there is a wide divergence of opinion among manufacturers of spark plugs will be noted by the types presented at Fig. *27*. Both ordinary spark plugs, so-called because they are adapted more especially to the chemical source of current, and the magneto type are shown. With the latter not only are the points set closer together, but they are of special alloys to resist the burning tendency of the spark produced by the magneto. It is obvious that in time the action of the current burns the surface away slightly and manufacturers of magnetos as a rule advise the use of magneto plugs because of this burning action. While the ordinary plug may give good service for a certain length of time when employed with the magneto, provided the gaps are correct, the writer holds that much of the supposed faulty action of the mechanical generator is due to the irregularity of the gaps on the ordinary plugs.

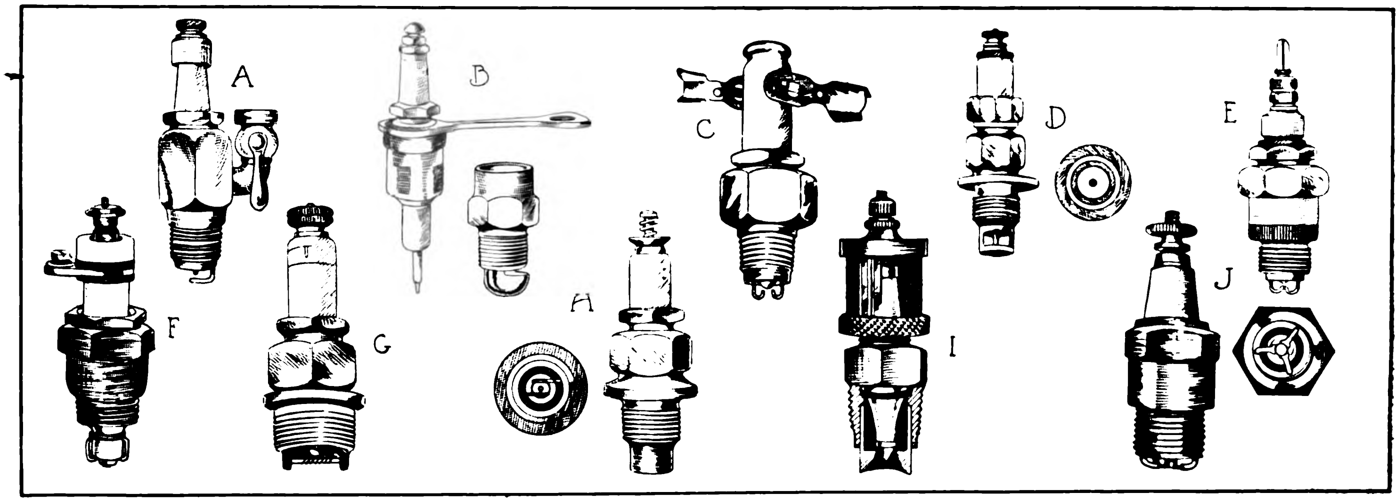


Fig. 27—Illustrating Conventional Types of Spark Plugs: A, All-in-One; B, Mosler Breech Block; C, Edison Double Plug; D, Mosler Spit Fire; E, Hartford; F, Lodge Double-Pole; G, Eisemann Magneto; H, Black Eagle; I, McCormick; J, Bosch Magneto.

A single gap is not always employed and there are a number of plugs marketed which have a multiplicity of terminals on the shell member. One of these is the Bosch, made by the Bosch Magneto Company, New York City, and shown at Fig. *27*. It will be noted that three electrodes having a knife shaped edge are integral with the shell and extend toward and into proximity to the central or main electrode. It is held of this construction that the spark does not jump but rather forms a ribbon of flame between the electrodes, making for greater efficiency and easier starting of the motor. Another quality of the design is that in the event of one point becoming sooted or creating too much resistance another member will provide the proper path. This make of plug is free from nuts or washers and the insulating material is fitted by a special process.

Magneto Plugs.

A type differing from the Bosch is the Eisemann, made by the Eisemann Magneto Company, New York City, and specially adapted for magneto work. It will be noted that a metal bar is integral with the shell and carries a spiral wire. That the central electrode is not always exposed is illustrated by the Mosler plug, made by A. R. Mosler & Co., Mt. Vernon, N. Y. Here the extension of the shell prevents oil from reaching the interior of the plug, the flame being projected into the cylinder through a small opening in proximity to which is the terminal of the central electrode. The sides of the extension part have suitable openings and it is held that the construction keeps cool the parts exposed to the heat of combustion. Owing to the liberal size of the electrodes it is claimed that the plug will operate equally well on the battery or magneto.

Some plugs are so constructed that the central insulated member may be removed easily by a slight turn of a handle and this type is known as the breech block plug. That shown at Fig. *27* is a Mosler and the end of the shell is spherical, protecting the sparking points from the action of oil, soot and heat. By moving the handle slightly, the central member may be displaced for inspection or other purposes.

In addition to the types illustrated, which include petticoat, conical and closed end, there are plugs which have a priming attachment. One of this construction is the All-in-One, made by the Frontier Specialty Company, Buffalo, N. Y., and shown at Fig. *27*. This comprises a petcock screwed into the shell and having a passage registering with the opening of the plug proper. This is designed for motors not equipped with priming cocks and where the plug must be removed when the cylinders are to be primed with gasoline for starting.

Double Pole Plugs.

The advantage of two point ignition is well recognized by engineers as with two sparks in the cylinder greater power and efficiency are derived, without util-

izing a double distributor magneto or double the number of wires. In the Lodge spark plug, marketed by Marburg Bros., New York City, two concentric electrodes are employed at the base of the core, both well insulated from each other and from the ground. This construction differs from those previously described in that there is no connection with the ground or between either of the electrodes.

All that is required is to have two spark plug openings for each cylinder and to connect the magneto and two plugs in such manner that one electrode of a double-pole plug is connected to the magneto and the other electrode of this double-pole plug to the insulated electrode of an ordinary plug. The current from the magneto will thus pass through both plugs in series and fire both at the same time.

Another type is the Edison double system plug designed for providing a dual system of ignition where the cylinder has but one spark plug opening. As will be noted by the illustration, two terminals are provided, one on either side, and the current from the battery, for example, is led through the secondary wire to one terminal. That from the magneto is secured to the other member. This permits of using either source of current independently of the other.

No attempt has been made to describe all the various types of spark plugs manufactured; rather to give a general description of spark plug construction and application. The adjustment of the gaps, cleaning, proper location, troubles and remedies will be taken up and discussed in logical sequence.

Having shown the method of converting the low-tension current into a high-tension by means of the induction coil and leading it to the gap of the spark plug, the timing of the flame will be considered. It was explained that the spark is supposed to take place at the completion of the compression stroke and that the timer is advanced in proportion to the speed of the piston to offset the time lost by converting the current from primary into secondary.

Timing the spark is a simple matter and is accomplished by varying the position of the rotating roller or brush member of the timer; that is, so securing it to the revolving shaft that contact will be made and the primary circuit established when the piston is approximately at top dead centre of the compression stroke.

There are several ways of timing the spark or setting the commutator and at Fig. 28 is shown the operation. The motor is cranked until the inlet valve of the first cylinder to be fired (that nearest the radiator when the power plant is a four-cylinder unit) opens and closes, and the piston has begun its upward or compression stroke. This may be determined readily by opening all of the petcocks except the No. 1 and when this is compressing that fact will be noted easily by the resistance.

Locating Position of Piston.

Having started the piston on the compression stroke, open the petcock and insert a wire or a small rod through the aperture. Next turn the flywheel by cranking until the rod raises and continue the rotation until the rod stops. By rocking the flywheel back and forth the exact dead centre can be determined without difficulty. With a file cut a nick in the rod flush with the top of the petcock. The mark will indicate the dead centre position. This is shown by the dotted lines in the drawing and that at A indicates that the piston is moving upward and lacks about half an inch of completing the movement. The correct distance may be secured by measuring off half

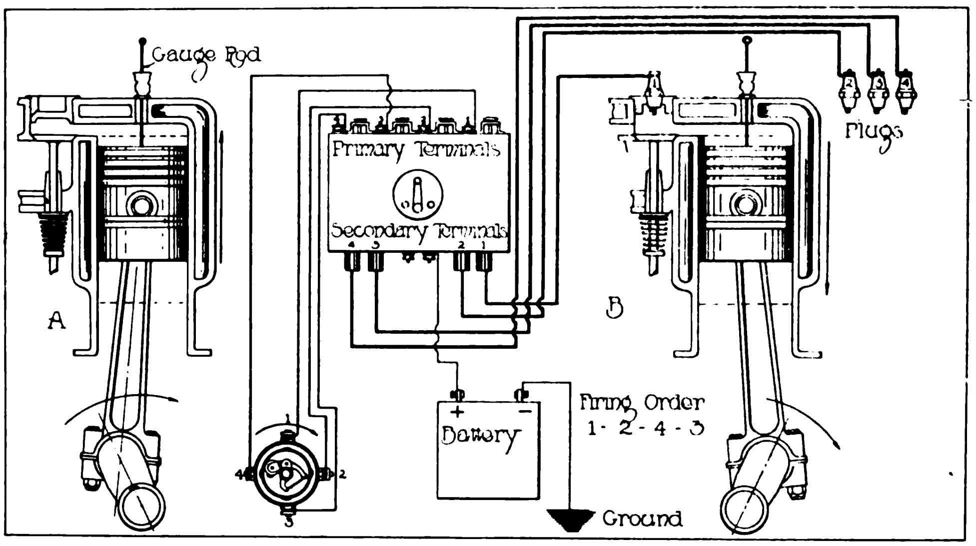


Fig. 28—Depicting Two Methods of Timing the Spark: A, Locating Position of Piston by Rod Inserted Through Petcock Opening, the Dotted Lines Representing Dead Centre; B, Timing of Spark with Timer in Fully Retarded Position and Wiring Plan with Motor Firing 1, 2, 4, 3.

an inch on the rod, above the original mark, and moving the flywheel backward or in an opposite direction to which it travels, until the second mark is flush with the top of the priming cup.

The roller member of the timer is then moved until the block makes contact with a terminal block and with the timer advanced to its maximum. The set screw or nut is then secured, locking the lever member in position.

While this is favored by some repairmen, the writer holds that the method shown at B has advantages in that there is no possibility of the novice making an error and inviting an accident through a back fire or carelesss operation of the spark lever in starting the motor.

The rod is utilized as before, but care must be taken to make sure that the piston is moving downward on the firing stroke. This is determined by in-

serting the rod and rotating the flywheel until the indicating member begins to descend. Continue the movement until the piston has descended about .5 inch, then set the roller member with the timer fully retarded.

By timing the spark in this manner there is no danger of the operator receiving a back kick with the starting handle, provided the spark lever is retarded. As he becomes familiar with the operation of the motor it is possible to advance the lever slightly for starting in cold weather, for example. In the event of play in the connections, should the timer advance slightly when the motor is stopped, the driver would not be as apt to be injured as with the other form of timing.

Wiring the Timer.

After setting the timer the next step is to connect the primary wires from the timer to the battery. The firing order of the motor must be known and this may be determined by watching the movement of the inlet valves. With four-cylinder motors the order will be either 1, 2, 4, 3 or 1, 3, 4, 2.

Assuming that the former is employed, the wire from the No. 1 terminal of the primary is connected to the primary post of the first unit of the coil. The second cylinder fires next and with the roller rotating in a clockwise direction the next contact to be made will be the second. This is connected with the second coil unit. As the firing order is 1, 2, 4, 3, it is obvious that the fourth cylinder fires before the third. In the natural course of rotation the next contact made in the timer is the third, so the wire from this post is carried to the fourth coil unit, since the fourth cylinder fires next in order and not the third as it would appear. The remaining post on the timer will be the fourth and this is connected with the primary member on the third coil as the third cylinder is the last to explode.

The attachment of the secondary wires is similar. As will be seen in the drawing the first and second cables, denoted by heavy black lines, lead to the first and second spark plugs, respectively. The third and fourth leads are then attached and in firing order. A little study of the wiring plan will enable the reader to understand the method of properly connecting the leads and it will be noted that the third and fourth contacts to be made by the roller are those of the fourth and third cylinder, respectively, when the firing is 1, 2, 4, 3. When the motor fires 1, 3, 4, 2, the primary and secondary wires must be attached to the cylinders in that order.

(To Be Continued.)

Ed. Note—The next installment will deal with high-tension distributors and various forms of igniters.

The Standard Glass Company, Chicago, has used a Buick commercial car, made by the Buick Motor Company, Flint, Mich., in its service for over a year and W. L. Eaton, general manager, states that the efficiency of the vehicle in carrying glass through the streets has been such that his company will completely motorize its equipment.

INAUGURATES SERVICE POLICY.

Grand Rapids Motor Truck Company to Assist Purchasers in Realizing Efficiency.

The Grand Rapids Motor Truck Company, Grand Rapids, Mich., has inaugurated a service department for the benefit of the users of "Decatur" trucks, and the purpose of the engineers of this department is to systematically assist those owning these vehicles in maintaining them, as well as to study and investigate the services with a view of securing the fullest measure of economy and productiveness. The department engineers are instructed to thoroughly tutor those having charge of the vehicles and then to supervise the work of the men and machines at frequent and regular intervals. The belief is that this department will bring about a decidedly increased efficiency and correspondingly minimize the expense.

GRAMM TRUCKS ABROAD.

Meeting with Decided Success in Philippine Islands and Under Similar Conditions Elsewhere.

Gramm trucks, made by the Gramm Motor Truck Company, Lima, O., are enjoying much popularity abroad. One firm at Manila, P. I., is using 25 of these vehicles and ordering others at the rate of about two a month. Honolulu is well supplied, several firms there using the Gramm to replace their horse and wagon delivery systems. Other countries using these machines are Brazil, Venezuela, Cuba, Porto Rico, Australia and New Zealand.

In some of the South American countries where steam and electric railroads have not penetrated and interurban transportation is proving a serious problem, the motor truck fills a long felt need. The Gramm company recently shipped a two-ton vehicle, equipped as a 20-passenger omnibus, to Brazil, where a firm of Americans has undertaken to establish a transportation service.

CO-OPERATION OF EMPLOYEES.

San Francisco Haulage Company Promotes Good Fellowship in an Interesting Manner.

The Emmons Safe Moving & Draying Company, San Francisco, Cal., each year tenders a dinner to its employees, at which it is customary for the workers to meet on a common footing and to consider subjects that are of interest to all and to develop a spirit of co-operation that is beneficial to the business of the company and promotive of the welfare of the workers.

This company two years ago began the use of Federal one-ton wagons and it now has four in service, with the probability of increasing this number materially. Through the wagons the company has decidedly developed its business.

LARGE TRUCK FOR MINE WORK.

California Concern Produces Vehicle of Special Design Fitted with Patented Dumping Feature.

The F. L. Moore Motor Truck Company, Los Angeles, Cal., has completed a Moore truck for the Kay Copper Company of Phoenix, Ariz., which is said to be the largest of its kind ever constructed. It is of special design and will be used for hauling copper ore from the mines to the smelter.

The truck has a four-cylinder engine, with large bore and long stroke, rated at 100 horsepower. The frame of the vehicle is made of steel girder heavily reinforced. It has a special patented power pump attachment which will dump the load in nine seconds, this being operated and controlled by the driver from the seat. The front wheels are 42 inches in diameter with wooden tires six inches thick and 13 inches wide. The total weight of the truck unloaded is 11,480 pounds. It may be loaded to seven or eight tons capacity and will pull trailers of similar capacity.

MACY'S THIRD REPEAT ORDER.

Fifteen Chase Delivery Wagons Replace 60 Horses in Service of New York Department Store.

R. H. Macy & Co., the well known New York City department store, has taken delivery of 15 additional Chase motor delivery wagons of 3000 pounds capacity each, made by the Chase Motor Truck Company, Syracuse, N. Y. They are stationed at the company's stable at Woodlawn, the Bronx, where they have displaced about 60 horses.

These vehicles are making daily deliveries over a wide territory, including the upper Bronx, practically all of Westchester county and nearby Connecticut. The Macy company has been using Chase trucks for 2.5 years and the last purchase is a third repeat order.

EFFICIENT MOTOR STAGE.

Reconstructed Locomobile Makes Daily Mileage of 90 with Very Satisfactory Results.

A Locomobile motor stage, placed in service about six months ago between Sacramento and Folsom, Cal., by the A. Meister & Sons Company of the former city, is unique in appearance, comfortable in appointments and very efficient in the duties it is called upon to perform. Supplying the motive power for the rear construction and stage body, both of which were designed by the Meister company, is a 1906 Locomobile 30 horsepower model H chassis, made by the Locomobile Company of America, Bridgeport, Conn., that had been driven over 120,000 miles before being adapted to its present service.

The rear or coach portion of the stage is very roomy, providing seating capacity for 24 persons as well as a large compartment for baggage and express purposes. The body pivots on a king bolt, which is fastened to the chassis and turns on a transom plate at the side. This stage, known as the Sacramento-Folsom air line, is in daily use between the two cities, making two trips, or about 90 miles a day at an average speed of 20 miles an hour. The total weight of the conveyance is 6000 pounds and the extreme length is 24 feet.

TESTING NEW POPE-HARTFORD.

Makes Run from Hartford to Boston Loaded to Rated Capacity Over Muddy Roads.

The first of the 1913 Pope-Hartford three-ton trucks, made by the Pope Manufacturing Company, Hartford, Conn., was recently delivered to the Boston service station of the company, making the journey from Hartford loaded with three tons of supplies. The vehicle left Hartford at 4 in the morning and arrived at Boston at 4:25 in the afternoon, making stops at Springfield and Worcester.

At the end of the run F. J. Glaser, who had charge of the trip, reported that the entire 130 miles was made on high gear and although the roads were muddy and slippery no adjustments of any kind were made. The gasoline consumption was approximately 6.5 miles to the gallon.

SUCCESS WITH KISSELKARS.

Chassis Fitted as Omnibuses Operating at Satisfactory Profit in Various Sections.

There seems little doubt that a man who can estimate transportation requirements and locate accordingly, can find in nearly any part of the country a fertile field for the motor 'bus. KisselKar 'buses, made by the Kissel Motor Car Company, Hartford, Wis., are in use in all parts of the United States and reports indicate that in every case the owners are operating at a profit.

A KisselKar line from Newburg to Cornwall, N. Y., paid so handsomely that the owner has added a second line from Port Chester to White Plains with equal success. Other recent instances of profitable operation of 'buses are cited at Chicago, Minneapolis, Providence, Detroit, Joliet, Ill.; Albany, N. Y.; Clarksburg, W. Va.; Highland Park, Ill., and Lynn, Mass. Many of these lines purchased the chassis only of the Kissel company, having bodies built and mounted in their own cities and according to their special ideas and requirements.

At the annual meeting of Adams Bros. Company, Findlay, O., maker of Adams trucks, these officers were elected: President, Joseph J. Kwis; vice president, C. H. Bigelow; secretary and sales manager, L. J. Adams; treasurer, B. B. Bigelow; general manager, W. D. McCaughey; purchasing agent, D. B. Adams.

New Commercial Car Accessories

Dean Regulite.

The Dean Regulite, marketed by the Waite Auto Supply mpany, Providence, R. I., is an electrical device designed for :achment to model T Ford automobiles when the generator utilized as a source of current for electric headlights. With is type of mechanical generator, the voltage varies in prortion to the speed of the motor and if the bulbs are not of oper size, at high car speeds the filaments are likely to beme destroyed. The Dean device regulates the pressure of e current, its principle being that of inserting resistance in e circuit automatically, and the maker holds that the lamps ill give a steady light irrespective of motor speeds. Excesvely high voltages are also prevented. The switch member is four steps or contacts to enable the adaptation of the sysms to generators of varying output of current. A feature the Dean is that the lamps may be dimmed if desired. It neatly constructed and takes the place of the usual lighting vitch on the dash. It is moderately priced.

Rayfield Strainer Trap.

The Rayfield strainer trap is produced by the Findeisen & ropf Manufacturing Company, Chicago, maker of the Rayfield irburetor. The device is designed for installation between ie supply tank and the vaporizer and is an important member the carburetion system in that it not only separates water id foreign elements from the gasoline, but prevents them aching the vaporizer and creating trouble. The fluid enters one end, flows directly to the bottom of the trap, and in risg to pass out, passes through a very fine metal screen. All cumulations are left in the bottom and may be removed by ieans of a petcock. A brace is part of the equipment and is esigned for attaching to any convenient frame or other car iember. The strainer is five inches high and 2.5 wide, and is onstructed to take .25, .3125 or .375 inch outside diameter tubig. It is constructed of brass, is nicely finished and is modrately priced.

Lubro Anti-Freeze Fluid.

Lubro Anti-Freeze Fluid, manufactured by the Lubro Oil ompany, 116 Prospect street, Cleveland, O., differs from the sual prepared solutions in that it does not require testing rom time to time to note if the freezing point has raised. It s a red fluid and the maker points out that there is no danger f the garage attendant emptying the cooler by mistake. One f the qualities of the fluid is that it does not boil or evaporate s readily as water and that it is especially adapted to moors which have a tendency to heat with alcohol solutions. The olor aids in locating tiny leaks in the circulating system and is also stated that it acts as a lubricant to the pump. It is eld that it prevents corrosion, thereby keeping the radiator lean. The company furnishes free of charge a preparation which will remedy leaks, when Lubro is purchased. One gal- on added to 3.5 gallons of water provides sufficient fluid for an rdinary radiator.

Hagstrom Priming Cup.

The Hagstrom priming cup, marketed by the Hagstrom ros. Manufacturing Company, Lindsborg, Kan., has been improved by the addition of a needle like member which may be adjusted to enrich the mixture if desired for starting purposes. The device is designed for attachment to the intake pipe or manifold between the carburetor and the cylinders and is utilized for priming purposes, in that the gasoline is inserted through a ball check opening at the top. When the motor is cranked the suction of the piston draws in a rich mixture and the fuel is vaporized by the attachment. The engine may be run with the rich mixture until the cylinders become warm. Features of the cup are that there are no levers to loosen or open and that the needle valve member may be closed or opened as desired.

Dover Saval Funnel.

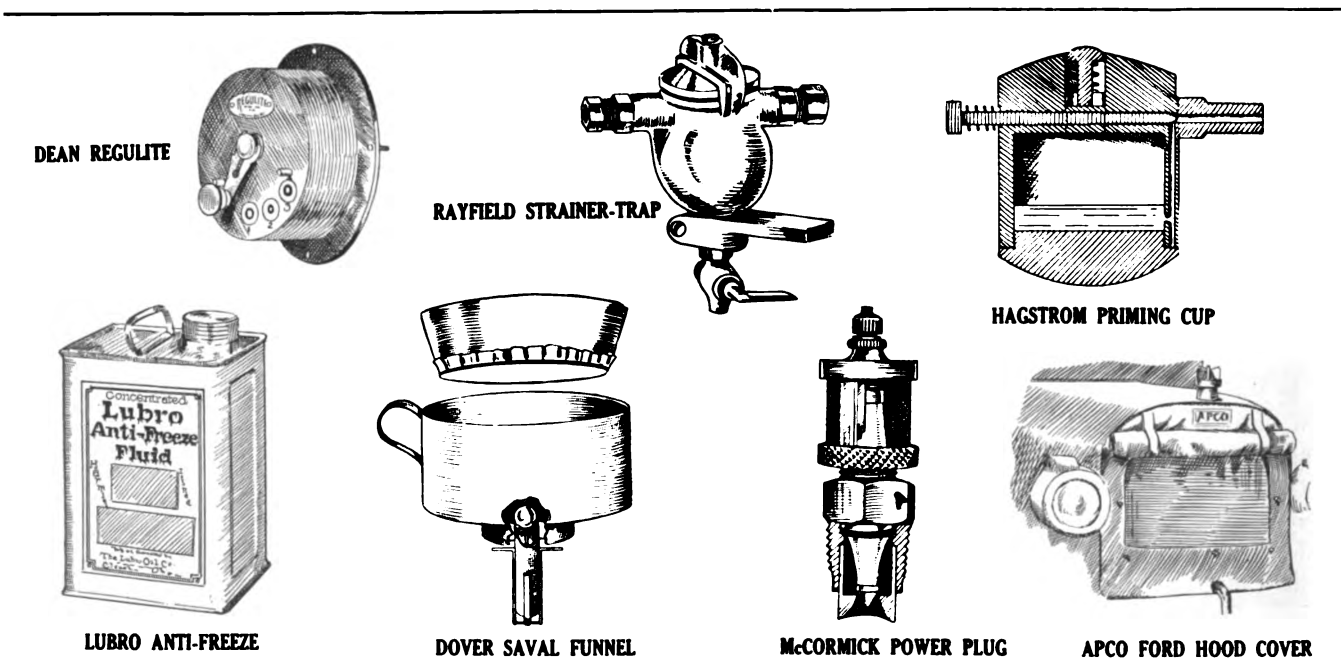
The Dover Saval funnel, produced by the Dover Stamping & Manufacturing Company, Cambridge, Mass., makes for economy and ease in the handling of gasoline and is adapted for both the garage and private owner. Spilling of the fuel is prevented when filling the tank as the flow is automatically cut off when the funnel is lifted from the filling hole of the tank. This makes for safety in addition to economy. The funnel is provided with a large hoop on the base which rests firmly on the bottom of the tank, eliminating the possibility of tipping. The hoop is equipped with apertures, venting the spout and preventing it from becoming air bound. This and the ample size of the spout allow the contents of the funnel to be emptied in a very short time. A new, special extra hoop extends the entire depth of the funnel, and serves to retain the chamois. The Saval funnel comes complete with chamois and is designed to withstand severe service.

Apco Ford Cover Hood.

A device for protecting the cooling system against freezing temperatures has been brought out by the Auto Parts Company, Providence, R. I. It is designed for model T Ford automobiles, is constructed of rubber cloth, nicely stitched, and completely envelopes the hood and radiator. The device is padded with felt, and has an adjustable curtain permitting of closing the front of the cooler or exposing it as desired and according to the temperature. The hood is permanently secured and not only protects the water from the cold, but makes for easy starting, in that it keeps the heated water warm for a considerable length of time. It is easily attached and moderately priced.

McCormick Power Plug.

The McCormick power plug produced by the McCormick Manufacturing Company, Dayton, O., presents interesting features in that a large number of high frequency sparks are produced and they are constantly moving around the terminals. The sparks take place in a sparking chamber having a single restricted opening. During compression the gas is segregated in this space and when exploded a flame is projected into the cylinder. The spark gap is circular in form and all points are held to be charged with the same potential. When the gap is broken down, that is, when the discharge takes place, all points discharge simultaneously, producing a shower of sparks. Greater motor efficiency is claimed.



Illustrating Some Accessories, Supplies and Fittings Which Are Well Adapted to Commercial Vehicle Uses.

The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., MARCH, 1913 No. 3

STRIKE PROVES MOTOR TRUCK ECONOMY.

Enforced Demonstration of the Practical Utility of Machines, Without Efficient Loading and Unloading Equipment and Facilities, to Coal, Lumber and Building Materials Trade at Pawtucket, R. I., Means Abandoning Horses.

Harnesses FOR SALE Carts	50 Horses FOR SALE Apply Within

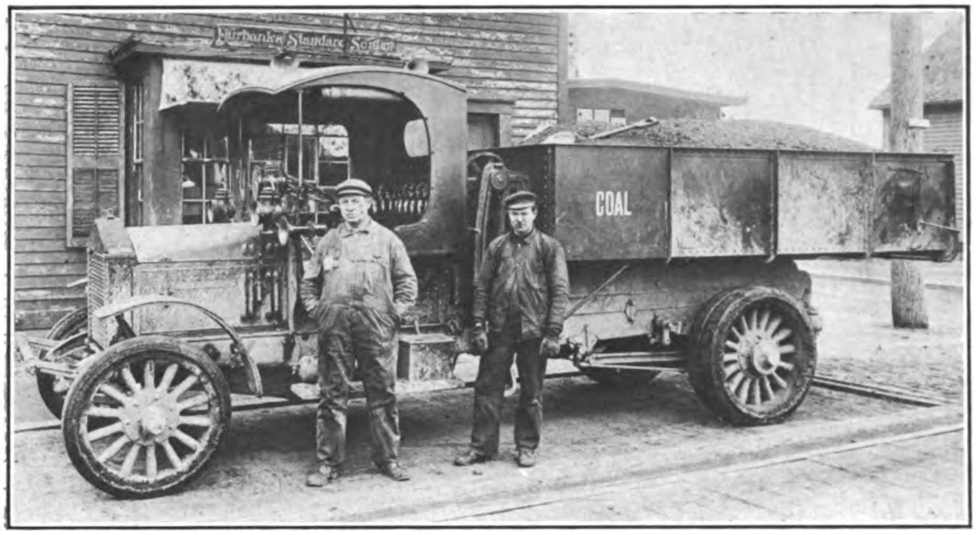
THESE two signs were placed in the office window of Olney & Payne Bros., Pawtucket, R. I., at the end of the first week of the strike of the Team Drivers' Union, and they were not removed when at the end of the second week the strikers abandoned their organization and individually sought to regain their employment. This concern is one of six engaged in coal, lumber and building materials trade in Pawtucket that refused to grant the demand of the drivers' union for an increased scale of wages, and it was the first of these to make public its purpose to motorize its delivery service as rapidly as it was possible to do this.

Weighing a Pierce-Arrow Truck and Its Crew at Olney & Payne Bros.' Office Before Going to the Yard for a Load of Coal.

For the first time probably in America motor trucks were utilized in an emergency of this character, and not only was business continued so that there was not material delay, but the practical demonstrations were such as to convince all of the firms that machines are in every way economical. While it was an enforced experience, representatives of the firms are unanimous in the opinion that they never would have had the practical knowledge gained because of the strike, and they all realize that there will be material saving for them to motorize their services. Some of them do not hesitate to say that the change must come quickly, for they understand the saving that can be made, and while it will undoubtedly mean a considerable expense in addition to the purchase of the trucks, there is no doubt of the purpose of the companies to dispose of their horse equipment as quickly as this may be done without sacrifice.

The six firms used about 300 horses and of the companies but one had seriously considered the use of trucks until the drivers made demand for increase of pay. Olney & Payne Bros. had last September taken delivery of a five-ton Pierce-Arrow truck; and another truck of the same size and make was received the morning the strike was begun. If the other firms had discussed the use of machines there was no serious thought of purchasing, because each man interested regarded the problem as one of very large proportions, and while it was generally believed the trucks were economical on long hauls, there was a firmly seated conviction that they would not show results as satisfactory as the horses when making deliveries to family trade.

But the strike made the use of trucks absolutely necessary, and they were worked under conditions that were decidedly adverse to maximum productiveness. This fact was understood and has been considered, and without exception every firm is agreed that the



Weighing a Pierce-Arrow Truck Loaded with Soft Coal Before Sending It Out for a Delivery Trip.

lumber and anthracite coal. It was using about 35 horses when the drivers went out on strike.

The City Coal Company, which deals in coal, wood, hay and grain, is the next in size and uses about 25 animals, and the H. R. McDuff Estate, dealer in lumber, has about 12 horses in its service. The total number of animals does not represent the entire equipment used for horses and wagons were at times hired temporarily.

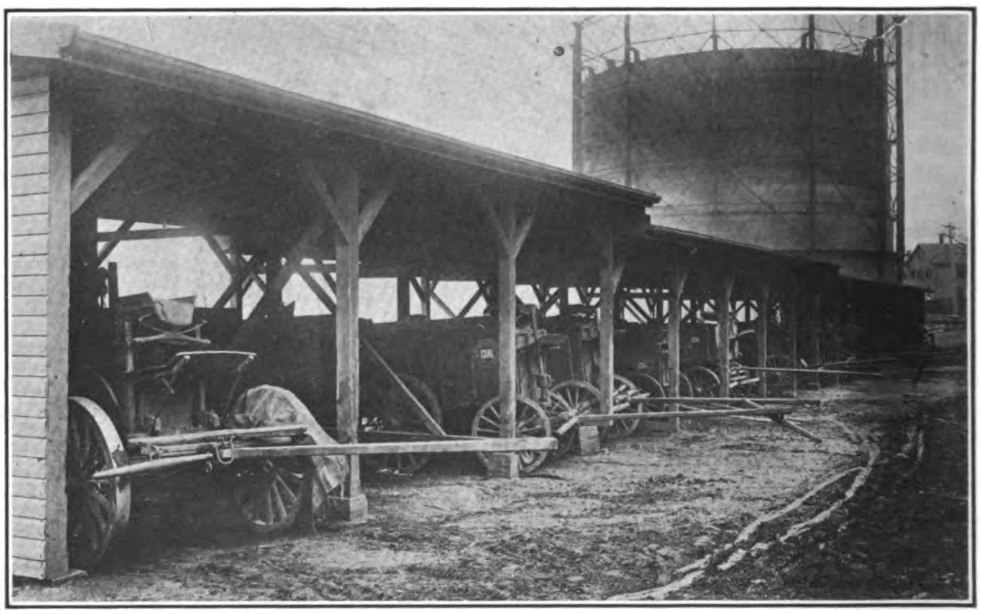
The distribution by these companies, aside from the H. R. McDuff Estate, is from yards located at either side of the Blackstone river, and generally the haulage is about the same, which would indicate a nearer approach to uniformity of service than is usually the case in a community. The hauls, of course, vary materially with patronage, but aside from the grades from the wharves and coal pockets the conditions are such that at least average work can be done with the animals.

The companies have for a number of years had agreements with the drivers' union and with the expiration of the specified periods these have been renewed. In this instance the employers rejected the demands of the men and a strike followed in which every union man participated. While the negotiations were pending the employers learned what men they might depend on in the event of a strike, and ascertained that they might hire from manufacturers' agents and dealers a number of motor trucks. It was not until the morning the men refused to work that the companies knew the conditions they had to meet, and when it

possibilities with trucks are very large. Not only this, but there has been well established in the mind of every member of an interested company that it will be decided economy to make the investment required by the change from horse equipment, although it will be large in each instance.

The six companies transact business in an area extending north in the Blackstone valley a distance of about 15 miles, and into the town of East Providence and the towns of Seekonk, Attleboro and North Attleboro in Massachusetts. Pawtucket is the head of navigation of the Blackstone river and is the distributing point for this territory for fuel and building materials. Of these Olney & Payne Bros. is the largest in point of delivery equipment and does a large business as a contractor for supplying bituminous coal for mills and manufactories, handling for one concern alone more than 30,000 tons a year. Besides this it deals in anthracite coal at retail, and in brick, lime and cement in large quantities.

Next in size is the Newell Coal & Lumber Company, which has a large number of anthracite coal contracts as well as an extensive retail business, and handles lumber, brick, cement and lime. This company was using upwards of 60 horses at the time of the strike. The third concern in point of animals owned is the McDuff Coal & Lumber Company, with 55 animals in daily use, and this firm deals in coal, lumber and builders' materials. The fourth in size according to delivery equipment is the John T. Cottrell Company, which manufactures lumber as well as having a large trade in unfinished



One-Half of the Wagon Shed at Olney & Payne Bros.' Yard, Showing the Idle Carts After the Strike Had Been Declared Off; the Firm Offering These Vehicles for Sale.

Pope-Hartford Platform Truck with Temporary Body Loaded with Bag Coal for Family Delivery, for Which Work Special Equipment Is Not Necessary.

was necessary for members of the firms in some instances to drive their own carts and to secure the aid of every man who could be spared from office forces to drive, the wires were kept busy to reach those who sold and used trucks.

Perhaps one of the reasons why the trucks were depended upon to a greater extent than might have been the case was that last September Olney & Payne Bros. began the use of a five-ton Pierce-Arrow machine, and this had been in constant service from that time. There was no knowledge, however, of what might be done with the haulage of lumber and building materials. With the declaration of the strike a member of the firm started in to drive this truck, for the driver had struck with the other union men, and the noon of the first day of the strike a second Pierce-Arrow truck, which had been ordered a month or more previous, was unloaded from a car. This gave the firm the second machine, and another member of the company started work with it that same afternoon. With the big contracts for soft coal there could be no cessation of the haulage between the yard and the works.

Meantime the Newell Coal & Lumber Company, the John T. Cottrell Company and the McDuff Coal & Lumber Company had arranged for the temporary use of several machines. It was found some of the agents for trucks in Providence were willing to let trucks for haulage for limited or unlimited periods, and owners of machines engaged in haulage not working on contracts were also willing to undertake the work. A number of Boston agents were communicated with and some were willing to have the companies use their trucks for indefinite periods. While it required quick action to gather a sufficient number of machines to meet the most urgent demands, before the end of the first day the companies had arranged for the use of about 20 trucks.

With horse equipment available the companies did not want to make plans for more than a day or two at the most for truck delivery, but a means had been found for continuing the deliveries and not one concern was seriously crippled, though with men not familiar with the city and not experienced there was not the same work done that would have been accomplished under normal conditions. It was necessary for the first few days to have a sufficient number of machines to take care of the work that was imperative, and delivery that was not absolutely necessary was left for the horse vehicles, for each company had found it possible to keep some of the animals at work.

The City Coal Company did not hire trucks, nor did the H. R. McDuff Estate, for with the former it was possible to keep up with the urgent demands with the drivers recruited from the yard and office forces, and with the latter the business in lumber was probably at the lowest point of the year. In fact the coal trade was the greater part of the delivery by all, for winter patronage is either from those who have use for coal constantly and have small storage facilities, or

The Soft Coal Loading Machine and a Truck with a Body from Which a Load Must Be Shovelled; a Combination but Partly Advantageous.

White Truck with Power Dumping Body Filled with Anthracite Coal by Shovellers; a Decided Loss of Time Through Lack of Yard Facilities.

could be obtained, conditional, of course, upon the termination of the strike.

The John T. Cottrell Company, while it has a large coal department, manufactures lumber, as well as dealing in unfinished stock, and though it was able to use some horses several trucks were hired. Some of the deliveries made by this concern are at considerable distances, and hauls of 15 miles are not infrequent. The McDuff Coal & Lumber Company was not as badly crippled as the others from the fact that it was the dullest period of the lumber trade for the year, and it was possible with the men available to keep pace with the business with a fewer number of trucks in proportion to its horse equipment.

those who require an additional supply to tide them over the period when heat is needed, with the occasional small orders from those who, from lack of resources, purchase according to the money in hand.

The first two or three days was the hardest period of the strike. It was indeed difficult to keep pace with the deliveries that were necessary through contract or emergency. The green workers were willing, but lacked experience, and this was a heavy handicap. The first day the greater part of the time was devoted to working the horse equipment with such drivers as were available and making arrangements for the trucks. Olney & Payne Bros. hired a Pierce-Arrow demonstrating truck and then a three-ton Packard truck. This gave the company four machines. The two Pierce-Arrow trucks with the dumping bodies were used to haul soft coal and the third machine of this make, which had a stake platform body, was fitted with temporary sideboards and, with the Packard, used for delivery of family orders. Next the third Pierce-Arrow truck was bought.

The Newell Coal & Lumber Company does a large lumber business, and as it was not practical to use the rented machines for delivery of stock of considerable length, so far as possible horses were used for this haulage and the trucks were used more for coal and construction material. A number of trucks, ranging from 1.5 to five tons capacity, were hired, and these were engaged for whatever periods they

The second day of the strike the companies had a fair knowledge of the delivery service each could command, and had located men who could furnish trucks should there be use for additional machines. Trucks that were placed at the disposal of the companies by friendly firms for a day or two were used while arrangements were made for those that could be utilized for longer periods, and with knowledge of the conditions a number of agents for trucks sought the opportunity to make demonstrations of a somewhat unusual character by offering to work their machines even as long as they were needed. As the companies were united in the refusal of the proposal of the drivers, and all were dealing with a like condition, there was a disposition to work the trucks to the greatest benefit, that is, letting the firm with the greatest need

Two Trucks at a Loading Machine, Both with Dumping Bodies, Showing the Possibilities of Delay Even with the Best Equipment Unless Work Is Well Planned.

Loading Two Trucks, a Pope-Hartford in the Foreground with an Extemporized Body and a Peerless in the Distance with a Quick Dumping Body, by Gravity, Showing the Value of Yard Facilities in Loading; the Loss with the First Truck Will Be Unloading.

spite this handicap the capacity and the speed of the trucks were such that there was a material gain in delivery. Handling brick, lime and cement better facilities would have made a decided difference.

The fifth day was the first of a week and Olney & Payne Bros. hired a fifth truck, a Packard three-ton machine, the Newell Coal & Lumber Company had eight trucks working, the John T. Cottrell Company six and the McDuff Coal & Lumber Company three, and with animal drivers hired the companies were able to make deliveries, so there were no serious delays.

have what was necessary for the time being, or conceding or receiving service.

By the third day of the strike the companies had good emergency organizations. Members of the companies drove their trucks and horses and the other men who were driving were generally inexperienced, but there was realization that with the hired trucks delivery could be made and business could be transacted. With but a part of the horse equipment serviceable and the unwillingness of many men to drive because of the strike the companies made ready for a continuance of the conditions for an indefinite period and based their determinations on the trucks available.

The fourth day was Sunday and the fifth day the companies began to gain slightly so far as drivers were concerned, which released for other work some of the men who had been driving. Despite the general lack of knowledge of the two cities and the several towns in which deliveries were made, and the absence of such loading facilities as would expedite the handling of the trucks, the machines gained surprising results. Only the two trucks owned by Olney & Payne Bros. were equipped with dumping bodies, and only this firm had mechanical loading equipment in its yards. All of the companies had facilities for gravity loading, but aside from family orders, which were handled with canvass bags, which could be filled during the absence of the trucks, shovelling was necessary in unloading.

With the lumber the conditions were such that instead of loading a wagon in the yard and having it in readiness to hitch horses to it whenever available, that there might be no delay, it was necessary to load and unload the truck while it was standing idle, and this caused the loss of considerable valuable time which might have been saved with loading equipment. But de-

The trucks were, aside from the two owned by Olney & Payne Bros., of the platform type with sideboards lashed to the platform stakes, and while these could be loaded where the pockets were built for gravity loading, it was necessary to shovel the coal when unloading. These were much more serviceable when the loads were in canvass bags, which could be handled by the yard men very quickly. Where the coal was not so it could be loaded by gravity it was necessarily shovelled, and only two of the demonstrated or rented machines, a White and a Peerless were fitted with power body hoists. But even with the power body hoists where the loading was with shovels there was considerable loss of time.

Olney & Payne Bros. had three loading machines in their yards, two at the wharf and the other at Darlington, all of which are used with bituminous coal. These are heavy constructions, weighing 3.5 tons, mounted on wheels, which are located at a coal pile and the coal fed to them by gravity and shovelling. A series of buckets, operating much the same as a bucket pump, is driven by an electric motor, and this will load five tons in from three to four minutes. Obviously, with the dumping bodies hauling soft coal meant

Weighing a Pope-Hartford and a G. M. C. Truck with Temporary Bodies, Illustrating the Saving with a Double Scale and the Equipment That Is Not Intended for Quick Delivery.

very little idleness, but with the extemporized bodies there was no loss while loading.

The practical efficiency of loading facilities was amply demonstrated. It was realized that with trucks it was necessary to have loading machines or to build pockets for gravity discharge, or to change the pockets now existing, and that dumping bodies were not only essential, but it was imperative that these be built with both end and side discharge so that unloading could be done in the least time possible. Under the system usually the vogue a driver reports to the yard office on reaching the yard and is given an order. He goes to the pocket where the coal is, loads his cart, returns to the office for weighing and starts. With the Pierce-Arrow trucks in the Olney & Payne Bros.' service about seven minutes was the average time for reporting until weighing, and the time required may be illustrated from one trip made to the water works at South Attleboro, rather more than five miles away, which was made in one hour and 10 minutes. This would have been a half day's work for a pair of horses and cart. Another illustration of the truck's value was when a Decatur wagon with two tons of coal, to be delivered to two different customers at South Attleboro, did the five-mile round trip with the two stops in 55 minutes. Several times loads were sent to the mills of the Samoset Company at Valley Falls, 2.5 miles each way, and the deliveries were made and the truck was back in 50 minutes.

What can be done with miscellaneous work was shown when the John T. Cottrell Company started a 3.5-ton truck hauling lath from the railroad station, a distance of slightly less than a mile from the yard. One morning 63,000 lath were hauled and at 1 a load was made up for Woonsocket, 12 miles distant. The driver was given an order to be delivered at Forestdale, three miles further than Woonsocket, and though he stopped on the road for his lunch and telephoned to learn whether he was wanted for the remainder of the day, he was back at the yard at 4:15, and took out another load and delivered it before 6. The Woonsocket trip would have taken 14 hours for four horses and two men, with the overtime pay, and the team would need be given light work the following day. In this instance the truck did more than a day's work in hauling the lath, it did a day's work to Woonsocket, to say nothing of the additional run to Forestdale (which was originally to be sent by freight), and it made another delivery that would have taken at least twice the time with horses, and all this with lumber.

The experience in lumber haulage, however, was that special equipment was needed so that there should be no time lost in the yard, and the unloading expedited as much as possible. Some of the dealers believe that a truck might be adapted to use as a tractor and some of the horse wagons utilized as semi-trailers when long stock is to be carried, so that these might be loaded in the yard and made ready for hauling whenever a truck is available, and that with short stock it is practical to pile the loads in the yards on dead wagons so equipped that the transfer can be made with little or no loss of time in the yard.

As will be noted from the illustrations, the conditions of the yards as a whole, so far as traction possibilities are concerned, could be very much improved, and that in which the best loading and unloading facilities are to be found is of made land that is saturated with water at this season of the year. Despite the use of material that might ordinarily give a consolidated surface the ground is very soft and yielding, and it is cut to a depth of a foot or more, so that when frozen the ruts make the yard hauls very severe for the trucks and extremely hard for the horses. The other yards are not as bad, but they are all more or less unfavorable, especially as in some the grades are heavy. Were the roads in the yards well surfaced a considerable saving in time would be effected in loading and leaving. Most of the yards have a double scale so that two loads may be weighed at once.

The experience of the members of the firm that drove the trucks has been, these men say without hesitation, of material value to them. While they both had driven the trucks before necessity required they had merely a general knowledge of the conditions of delivery, but when they drove the machines each day they not only learned what might be done with ordinary care and discretion, but what was possible in emergencies. As one of them expressed it: "We know just what a truck will do and how it ought to be worked to afford, in our opinion, its best service. We know what time is needed for a given work and we know how a truck should be driven to protect it against unnecessary wear and damage. Not only this, but from our knowledge of animal carts and trucks we are certain that the machines will do our work, do all of it, and do it faster. What is necessary is to keep the trucks moving and to minimize the time of loading and unloading. As to the endurance of the machines, that is really something for us to give attention to and not to leave to the discretion of the men who drive them. The experience we have had has been extremely valuable to us, and I believe that it would be a decided benefit to any owner of trucks to have an intimate knowledge of just how his delivery is made and the conditions under which his drivers do their work."

Without exception the opinion prevails that the trucks have been well tried under the unfavorable conditions of an emergency and that they have been found to be in every way practical. Quite as unanimous is the belief that satisfactory means can be found for expeditious handling of the loads at either end, and that the installation of such equipment is imperative. In other words, the trucks are economical from every point of view when those owning them mean to make the most of them. While the question of maintenance and upkeep has not been considered in this trial it is realized that the machines must be well cared for to endure, but with practical methods it is known that they will give continued service. Trucks will be bought and bought quickly as a result of the experience, that is certain, and it would not be surprising if a co-operative garage was an outcome as well.

BOSTON'S TRUCK SHOW THE BEST OF YEAR.

Sixty Makes of Vehicles, Four New to the Industry and 17 Not Before Seen at This Exhibition, and 60 Accessory Exhibits, Will Be Shown.

THE display of motor delivery wagons and trucks to be made at Mechanics' building, Huntington avenue, Boston, beginning at 8 in the evening of March 19 and concluding the night of March 26, will be the most interesting and attractive exhibition of the kind ever held in New England, when regarded from the viewpoint of automobile vehicle development. But it will have many other aspects that will make it of unusual importance, both to the industry and to the users of highway transports.

While it is not expected that the show will attract those who are merely curious, for there is little that will draw those who are unconcerned to such an exhibition, the experience of previous shows has proven that each year the number of visitors purposing buying has increased to an extent not even realized by those who are identified with the selling of machines.

New England is today a different market than the remainder of the country so far as the sale of power wagons is concerned. The railroad transportation is controlled practically by three corporations, which are non-competitive, and within the states service is not only extremely costly as compared with sections of the nation where there are competing railroads, but it is so slow as to be an extreme handicap to business. No endeavors by the strongest of commercial bodies or influence that have been invoked have been productive of improvement either with reference to expense or time, and with demands of patronage it has been necessary to resort to express shipments with a much greater volume of business than elsewhere in the country.

New England differs from other parts of the nation in that there are many commercial centres, each of which attracts the population of a reasonably definite area. These cities are distributing as well as receiving points, and the direct highways afford a means for transportation that is so economic as to justify their use to an extreme, and this character of haulage, as well as distribution, has been developed through the use of the motor vehicle. The New England highways have been improved by the expenditure of large sums of money by each of the states, and in southern New England the road systems have been greatly developed.

The limitations of animal haulage were not realized until the possibilities with motor trucks were known, and there is a rapidly increasing conviction that with change of facilities that are entirely reasonable and within the resources of the majority of busi-

Mechanics' Building, Huntington Avenue, Boston, Where the Annual Show of the Boston Commercial Motor Vehicle Association Will Take Place, March 19-26, Inclusive.

ness enterprises a decided saving can be made.

Last year the number of motor wagons and trucks placed in service in New England was, conservatively estimated, at least three times that of the previous year, and there is reason to believe there will be at least the same ratio of increase of sales made as compared with 1912. It is certain enough that there are many firms and business men who have been converted by the practical experiences of others, and they have made observations that convince them of the serviceability of machines.

The coming show will be from every point of view an attraction to the man who is engaged in business. There is no apparent reason why there should not be economy in a delivery or haulage service. The progressive man of affairs, though he realizes that any financial statement of his service will show no revenue and a constant expense understands that if this cost can be reduced, even at a material initial expenditure, it is a saving in every sense. The effects of competition impel better delivery service, for this is one of the greatest essentials making for satisfaction. This applies to practically every business enterprise of consequence, and it is this knowledge that will impel the insight of those directing them into the qualities of vehicles that may be adapted for their use.

Officers and Directors of the Boston Commercial Motor Vehicle Association.

The show will contain 60 exhibits of different makes, and these will represent at least 125 power vehicles of differing types, sizes or models, which will range from the very light package wagon to a seven-ton truck. Practically every form of construction will be shown, and the power will be by both steam and gasoline engines and electric motors. While this number of vehicle exhibitors will be four less than in 1912, the show will be in every sense larger, and it will represent the cream of the power wagon industry. More makes were shown at both New York and Chicago, but there were at each of these exhibitions a number of machines that were seen for the first time. Though total makes of vehicles shown may be regarded as the basis by which to judge a show, it is a fact that the real measure is the character of the displays and the attraction they will have for the visitors.

The 60 exhibits will consist of 51 makes of gasoline wagons and trucks, eight makes driven by electric power, and one using steam for propulsion. There will be seen a representation of electric vehicles which will be the equal of any seen at any exhibition in America.

The exhibits of gasoline machines will include two that have not before been shown, the B. M. C., which will be seen at the stand of the Boston Motor Company, and the Sowers, which will be the exhibit of Sowers Motors Truck Company. There will be one electric line that has never before been shown, the Edison, made by the Edison Electric Vehicle Company, while the Couple-Gear trucks and tractors, and the Eldridge front-drive electric carts and caravans, the displays of the Eldridge Manufacturing Company, have not been previously shown this year. The Couple-Gear machines are standard productions and are well known, but the Eldridge has not been shown at an exhibition, although a number of these have been in use in Boston and vicinity for a considerable length of time. The Stanley line of steam delivery wagons was shown at Boston last year, but not since that time at any show.

There will be a considerable number of gasoline wagons and trucks that will be new to Boston. These include the Adams wagons and trucks, shown by the Power Truck Sales Co.; the Best and Flint wagons, built by the Durant-Dort Carriage Company; the Hercules wagons, made by the Flanders Motor Company; the Jeffery, produced by the Thomas B. Jeffery Company; the Stewart, shown by H. Ross Maddox of Medford, Mass.; the Sullivan wagons, built by the Sullivan Motor Truck Company; the Lippard-Stewart wagons and the Schacht trucks and wagons, shown by the Whitney-Barney Company; the Overland wagons, shown by the Connell & McKone Company; the Little Giant wagons, built by the Chicago Pneumatic Tool Company; the Marmon wagon, shown by the Frank E. Wing Motor Car Company; the Smith-Milwaukee trucks, shown by the A. O. Smith Company; the Standard trucks, shown by the Whitten-Gilmore Company; the Universal wagons and trucks, shown by the Universal Motor Truck Company; the Vulcan trucks, shown by the Bessemer-Vulcan Motor Truck Branch; and the new electrics will be the Atlantic trucks, built by the Atlantic Vehicle Company, and the Buffalo wagons, built by the Buffalo Electric Vehicle Company, shown by the Dodge Motor Vehicle Company. This will make a total of 21 machines that will be practically, if not entirely, new to New England, or at least new since the last exhibition.

One feature of the show will be the exhibits of special bodies, some fitted with manual and power hoists for quick dumping, some designed for haulage of packages and containers, and others intended for more general work. While the majority of the body equipment shown will be built for practical use, there will be seen some admirable examples of workmanship and finish. Equally as interesting as the chassis will be the bodies, and these will no doubt receive the careful attention of the visitors. The number of exhibitors of accessories, equipment and supplies number 60.

THE TRUCK SHOW EXHIBITORS ALPHABETICALLY CLASSIFIED.

Gasoline Business Vehicles.

Adams, Power Truck Sales Co., Worcester, Mass.
Alco, American Locomotive Co., 567 Boylston St.
Atterbury, Leslie G. Rawding, 585 Boylston St.
Autocar, Autocar Co., 642 Beacon St.
Bessemer, Bessemer Motor Truck Co., 58 Church St.
Best, Durant-Dort Carriage Co., Flint, Mich.
B. M. C., Boston Motor Co., Boston.
Buick, Buick Motor Co., 97 Massachusetts Ave.
Chase, Chase Motor Truck Co., Syracuse, N. Y.
Decatur, Grand Rapids Motor Truck Co., Cambridge, Mass.
Federal, Whitten-Gilmore Co., 907 Boylston St.
Flanders, Flanders Motor Co., 589 Boylston St.
Flint, Durant-Dort Carriage Co., Flint, Mich.
Garford, R. & L. Co., 915 Boylston St.
G. M. C., General Motors Truck Co., 753 Boylston St.
Gramm, Connell & McKone Co., 555 Boylston St.
Hercules, Flanders Motor Co., 589 Boylston St.
Hupmobile, H. J. Koehler S. G. Co., 1074 Boylston St.
I. H. C., International Harvester Co. of America, Somerville, Mass.
Jeffery, Thos. B. Jeffery Co. of N. E., 640 Commonwealth Ave.
Kelly-Springfield, Kelly-Springfield Motor Truck Co., Cambridge, Mass.
Knox, Underhill Co., 885 Boylston St.
Koehler, H. J. Koehler S. G. Co., 1074 Boylston St.
Lauth-Juergens, Myer Abrams & Co., Cambridge, Mass.
Little Giant, Chicago Pneumatic Tool Co., 191 High St.
Lippard-Stewart, Whitney-Barney Co., 34 Merchants Row.
Locomobile, Locomobile Co. of America, 700 Commonwealth Ave.
Mais, Mais Motor Truck Co., Indianapolis, Ind.
Marmon, F. E. Wing Motor Car Co., Motor Mart.
Mercury, Mercury Mfg. Co., Chicago, Ill.
Overland, Connell & McKone Co., 555 Boylston St.
Packard, Packard Motor Car Co. of Boston, 1089 Commonwealth Ave.
Peerless, Peerless Motor Car Co. of N. E., 660 Beacon St.
Pierce-Arrow, J. W. Maguire Co., 745 Boylston St.
Pope-Hartford, Pope Mfg. Co., Hartford, Conn.
Reo, Linscott Motor Co., 163 Columbus Ave.
Sampson, Flanders Motor Co., 589 Boylston St.
Sanford, Sanford Motor Truck Co., Syracuse, N. Y.
Schacht, Whitney-Barney Co., 34 Merchants Row.
Selden, Boston Motor Co., Boston.
Smith-Milwaukee, A. O. Smith Co., Milwaukee, Wis.
Sowers, Sowers Motor Truck Co., 126 Massachusetts Ave.
Speedwell, Curtis-Hawkins Co., 162 Columbus Ave.
Standard, Whitten-Gilmore Co., 907 Boylston St.
Stewart, H. Ross Maddocks, Medford, Mass.
Sullivan, Sullivan Motor Car Co., Rochester, N. Y.
Universal, Universal Motor Truck Co., 193 Pleasant St.
Velie, Velie Boston Branch, 92 Massachusetts Ave.
Victor, Victor Motor Car Co., 75 Haverhill St.
Vulcan, Vulcan Motor Car Co., Boston.
White, White Co., 320 Newbury St.

Electric Business Vehicles.

Atlantic, Atlantic Vehicle Co., New York City.
Buffalo, Dodge Motor Vehicle Co., Cambridge, Mass.
Couple-Gear, Eldridge Mfg. Co., 178 Devonshire St.
Edison, Edison Electric Vehicle Co., Lawrence, Mass.
Eldridge, Eldridge Mfg. Co., 178 Devonshire St.
G. M. C., General Motors Truck Co., 753 Boylston St.
G. V., General Vehicle Co., 84 State St.
Waverley, J. W. Bowman Co., 91 Massachusetts Ave.

Steam Business Vehicles.

Stanley, Stanley Motor Carriage Co., Newton, Mass.

Accessories.

Ajax-Grieb Rubber Co., New York City, tires.
Baldwin Chain & Mfg. Co., Worcester, Mass., chains.
Batavia Rubber Co., Batavia, N. Y., tires.
Bell, Bayers & Woodbury, 121 Massachusetts Ave., batteries.
Bowser & Co., S. F., Fort Wayne, Ind., storage systems.
Boyd, F. Shirley, 903 Boylston St., general line.
Brown Trafilog Co., Cleveland, O., service recorders.
Champion Ignition Co., Flint, Mich., ignition devices.
Clark Foundry Co., Rumford, Me., metals, castings, etc.
Coes Wrench Co., Worcester, Mass., wrenches.
Cordtmeyer, F. H., New York City, novelties.
Cramp Ship & Eng. Bldg. Co., Wm., Philadelphia, Penn., castings, etc.
Dean Electric Co., Elyria, O., ignition devices, horns, etc.
Diamond Rubber Co., Akron, O., tires.
Dixon Crucible Co., Jos., 49 Federal St., graphite lubricants.
Edison Storage Battery Co., Orange, N. J., batteries.
Electric Storage Battery Co., Philadelphia, Penn., batteries.
Federal Chain & Mfg. Co., Springfield, Mass., chains.
Firestone Tire & Rubber Co., Akron, O., tires.
Fisk Rubber Co., Chicopee Falls, Mass., tires.
Gibney Tire & Rubber Co., Philadelphia, Penn., tires.
Globe Wrench Co., Ipswich, Mass., wrenches.
Goodrich Co., B. F., Akron, O., tires.
Goodyear Tire & Rubber Co., Akron, O., tires.
Gray & Davis, Lansdowne St., lighting and starting devices.
Harris Oil Co., A. W., Providence, R. I., lubricants.
Hartford Suspension Co., Jersey City, N. J., shock absorbers, jacks, starters.
Heinze Electric Co., Lowell, Mass., ignition devices.
Kelly-Springfield Tire Co., New York City, tires.
MacDonnell Co., Webster, Haverhill, Mass., novelties.
Marburg Bros., New York City, magnetos, ball bearings, etc.
Meyer Bros., New York City, novelties.
Motor & Accessory Manufacturers, New York City, association.
Motor Parts Co., Philadelphia, Penn., general line.
Motz Tire & Rubber Co., Akron, O., tires.
National Tube Co., Pittsburg, Penn., tubing, etc.
Never-Skid Mfg. Co., New York City, anti-skidding devices.
Pennsylvania Rubber Co., Jeannette, Penn., tires.
Perfection Filler Co., Somerville, Mass., tire filler.
Polack Tyre & Rubber Co., New York City, tires.
Remy Electric Co., Anderson, Ind., ignition devices.
Robinson & Son Co., Wm. C., 43 Commercial Wharf, lubricants.
Rose, P. R., Boston, Mass., novelties.
Service-Recorder Co., Cleveland, O., service recorders.
Sewell Cushion Wheel Co., Detroit, wheels.
Splitdorf Electrical Co., Newark, N. J., ignition devices.
Standard Welding Co., Cleveland, O., rims, etc.
Stewart & Clark Mfg. Co., Chicago, Ill., speedometers.
Swinehart Tire & Rubber Co., Akron, O., tires.
Texas Co., New York City, lubricants, storage systems.
U. S. Light & Heating Co., New York City, starting and lighting systems.
United Rim Co., Akron, O., rims.
United States Tire Co., 863 Boylston St., tires.
Vacuum Oil Co., New York City, lubricants.
Veeder Mfg. Co., Hartford, Conn., speedometers, hub odometers, etc.
Vesta Accumulator Co., Chicago, Ill., batteries.
Warner Instrument Co., Beloit, Wis., speedometers.
Whitney Mfg. Co., Hartford, Conn., chains.
Willard Storage Battery Co., Cleveland, O., batteries.
Wolverine Lubricant Co., 899 Boylston St., lubricants.

DISTRIBUTE STOCK WITH SEVEN-TON VULCAN.

THE John T. Connor Company, wholesale grocer, Boston, Mass., which is probably the largest concern of the kind in New England, has used since last September a seven-ton Vulcan truck, which is one of the largest machines in Boston, with a degree of success that is surprising, considering the conditions in which the work is done. The present purpose of the company is to utilize additional trucks and it may, because of the possibilities for transportation, change the location of some of its warehouses.

The business districts of Boston are notorious for the narrow streets, and because of the necessities of traffic haulage has been regulated to such an extent that it is impossible to utilize any kind of conveyance to its greatest capacity, which absolutely prevents using the truck so as to realize its fullest economy. Yet there is no question of its efficiency and its economic value in the service in which it is used.

The Vulcan Seven-Ton Truck Used in Distribution by the John T. Connor Company, Wholesale Grocer, to a Chain of Stores in Boston and Vicinity.

One of the warehouses, where the groceries are stored, is in Utica street, directly across the thoroughfare from the Boston & Albany freight houses, and it extends through to South street. A great deal of flour is received by railroad and is transferred by cart from the freight houses to the storehouse, this necessitating just the same handling as though the distance were miles, and requiring more time than might be imagined because of the congestion. As may be assumed, the delivery sections of the freight yard are crowded from early in the morning until well into the evening, and with wagons backed to the buildings at either side there is a passage only sufficient for one vehicle to pass through. This passage can only be maintained by turning the horses at right angles to the carts.

That there is but a narrow lane between the vehicles means that the movement of every conveyance is badly restricted, and as there are often many waiting for vacancies at the delivery platforms it is necessary for the police to keep the other side of the street as free as possible. They will permit the use of carts when the horses can be turned at one side, but motor trucks that are longer than carts cannot be used. As might be assumed, any unusual congestion of the street immediately becomes a serious matter, for it means the loss of time for hundreds, representing in the aggregate thousands of dollars. Side loading is out of the question because of the platform space required and there can be no remedy unless it is to widen the street by encroaching upon the railroad or the private property.

Because of the conditions at the freight house the big Vulcan cannot be used in any service that will take it into Utica street and so its usefulness is confined to the haulage of butter, eggs and potatoes. South street is wider and the conditions for loading are more favorable. The machine cannot be backed to the sidewalk, but it can be side loaded, and the class of freight carried can be handled comparatively rapidly. The work is slower than end loading, but the packages can be lifted and placed in the truck without a great deal of exertion.

The Connor company has a chain of 115 retail grocery stores in Boston and vicinity, and it is necessary that the stock of all of these, or at least the greater part, be distributed according to the demands, and it is for this distribution that the truck is used. Cases of eggs weigh about 60 pounds each and tubs of butter about 76 pounds, and 120 tubs and 100 cases will make a load slightly in excess of the rated capacity of the truck. When this class of freight is hauled the distribution is usually to the suburban stores, but often three and sometimes four loads are carried out, while any one of these loads would be all that a horse cart could take out in a single day, though it might be possible to take care of two loads if the hauls were not long.

At a storehouse in Charlestown potatoes are stored and these are distributed in a like manner. The potato sacks weigh 120 pounds each and 115 sacks make an average load, which is about twice what would ordinarily be carried by horse wagon. The body space is

sufficient to take 120 sacks, but this number would overload the truck and though the distribution may be begun within a distance of three or four miles, it is not the policy of the firm to permit overloading.

The average daily mileage of the truck, which has a maximum speed of 12 miles an hour, is between 50 and 60, although in a number of cases 75 miles have been traversed. Outward trips may go as far as 12 to 15 miles from the warehouses, but the distance may be double that indicated by a direct line on the map. The economy of the long hauls, despite the loading and unloading conditions, for practically at every stop the driver and his helper have no assistance and at best it is seldom practical to unload direct from the machine to the store, is unquestioned.

Early last summer the company, which then had all its haulage done by contract, decided to try a truck, and a Commer machine was demonstrated by the Dodge Motor Vehicle Company. This proved very satisfactory and the truck was hired to do regular haulage until the Vulcan was delivered. It was worked about three months and with the delivery of the Vulcan this machine was placed in the service described. The contract haulage was continued and it is the vogue now, but it will be somewhat reduced this spring when a new truck is delivered, as is now the intention of the company. The Vulcan truck is garaged at the service station of the Vulcan-Bessemer Motor Truck Branch in Church street, and a service attention is given it there. A reasonably accurate account of the work performed is kept and while a system has not been devised it is known that the truck is doing what would not be possible with animals.

ESTABLISHES BRANCH FACTORY.

Body Builder Takes Over Plant in Detroit Formerly Occupied by Grabowsky Company.

The Edward G. Budd Manufacturing Company, Philadelphia, Penn., maker of automobile bodies, will shortly establish a branch factory at Detroit. The advantages of being in the heart of the industry became apparent when an opportunity presented itself to purchase the plant formerly occupied by the Grabowsky Power Wagon Company, and the Budd Company has taken possession of this. The property consists of 8.5 acres of land with buildings and the price paid was $110,000. The appraised valuation is said to be $140,000. Contained in the purchase is a modern reinforced concrete building, four stories high, with 72,000 square feet of floor area, and a modern power building. There are also several sheds which the Grabowsky company utilized for storage purposes.

The Budd plant in Philadelphia will be operated to supply the trade in the East and south of Toledo, O., while the Detroit branch will handle the Michigan business and part of the West. By next May it is anticipated the production will total 30 completed bodies a day. The Edward G. Budd Company was organized in June, 1912, with capital of $500,000, all paid in, and manufactures pressed steel bodies for commercial and pleasure cars.

ECONOMICAL OF GASOLINE.

Knox Martin Truck Demonstrates Its Ability Under Peculiarly Trying Circumstances.

A Knox Martin tractor, built by the Knox Automobile Company, Springfield, Mass., in the service of a lumber company at Sacramento, Cal., was recently put to a severe test which demonstrated in a most convincing manner the wonderful pulling power of this type of vehicle. A large derrick at work on the lumber company's new wharf broke under the strain and the nearest one available was 16 miles away. Its length was over 70 feet and would have required two flat cars to transport it by railroad.

The tractor, however, easily pulled it out of its location in a large heap of scrap iron and delivered it at the wharf in a little more than 1.5 hours. The derrick was so firmly imbedded in the scrap iron that the tractor had to drag it through 10 feet of the pile before it was free. The demonstration was all the more remarkable when it was found that the tractor had averaged over four miles to a gallon of gasoline in spite of the heavy burden.

A TRAVELLING BOOKCASE.

Library in Hagerstown, Md., Inaugurates Innovation for Supplying Readers in Rural Districts.

A motor truck has been put to a novel use by the trustees of the public library of Hagerstown, Md., who recently purchased a "travelling bookcase" to deliver books from house to house in the rural sections. As far as is learned this is the only automobile of its kind in existence. It was built to order by the International Harvester Company of Chicago, and when the doors are closed the machine looks exactly like a dry goods or grocery delivery automobile.

The vehicle has a capacity of 1000 volumes, some being carried in cases to be left at the various substations, while others are arranged on shelves on either side in order that selection may be made as the machine stops in front of farmhouses and homes in villages too small to maintain sub-stations. The car is of 20 horsepower.

C. W. Martin, manager of the motor truck department of the Goodyear Tire & Rubber Company, Akron, O., maker of Goodyear tires, has announced that there is to be a reduction of 10 per cent. in the cost of Goodyear truck tires. This he states is due to the immense production of the plant, as a result of the demand for Goodyear truck tires.

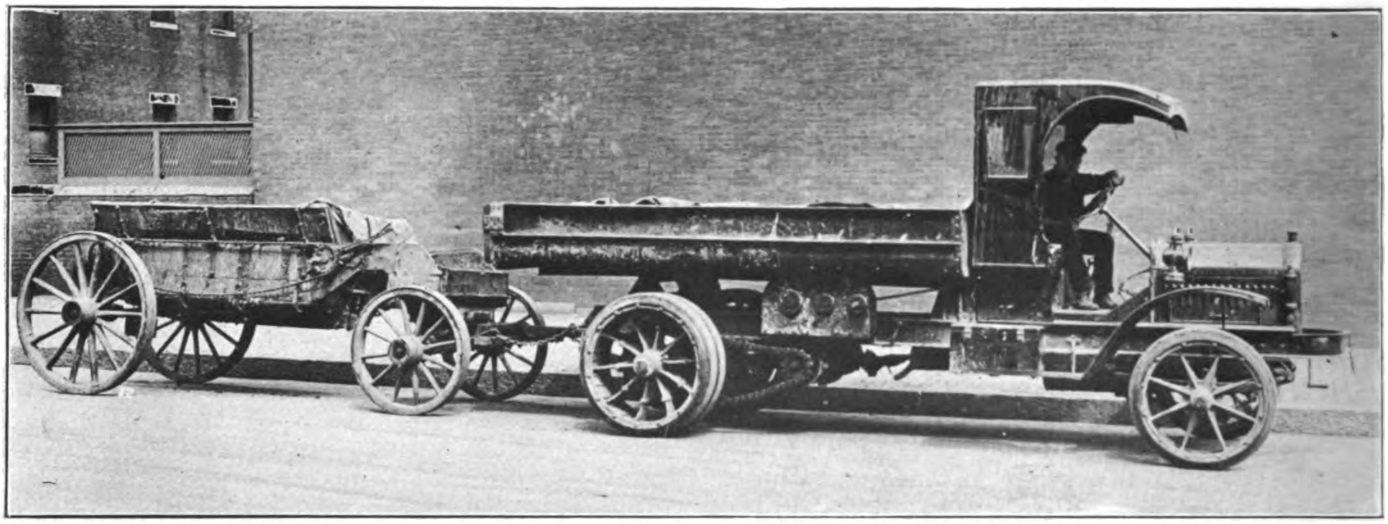
TRUCKS LOWER HAULAGE COST A THIRD.

Without Change of Facilities Adapted for Horse Service Warren Bros. Company, Paving and Roofing Contractor, Attains Large Ratio of Economy at Cambridge Plant.

THE utilization of motor trucks and wagons with facilities and equipment that have been developed for animal vehicles is the problem business men who consider economy of transportation invariably have to meet. The natural conclusion is that there should be as little sacrifice as is possible if the animals are to be displaced, and with the majority at least the inclination is to minimize expense in whatever changes may be regarded as necessary.

There are few who will regard a translation of a transportation department of a business from the same viewpoint that they will any other proposition that has to do with economy. Lessened cost of production, for instance, is always understood and is seldom a subject for issue, but most men are inclined to doubt the efficiency and utility of the power and are doubtful as to the expense that they are justified in incurring. Without question most of them believe and to apply whatever will be useful and reject what may be impracticable, and creating a system that will be both efficient and economical, may not appeal to those who would dispose of the problem of making a purchase. But it is certain enough that those who give an attention to haulage equal to that given to any other department of a business will find at least a reasonable saving in every way practical.

When a transportation service is comparatively small and the demands vary decidedly at different seasons of the year, the solution, so far as the use of motor wagons is concerned, is far more difficult to attain than one where the requirements are reasonably constant. The large concern often has a specific character of work that is not variable, and work can be depended upon, but where there is a considerable elasticity necessary and a loss results from all excess equipment whenever it is idle, the careful manager



Five-Ton White Truck with Special Dumping Body, and Two Cubic Yard Watson Wagon Converted as a Trailer, Used by Warren Bros. Company, Paving and Roofing Contractor, at Cambridge, Mass., Plant.

that prudence demands that they make expenditure as they are convinced by results, and they feel that they cannot accept anything less definite than their own experience.

It is certain enough that a progressive man will make careful estimate of any division of his business and will be satisfied to base his judgment on his knowledge. For instance, he will accept a statement as to the productiveness of machine equipment or tools, and he knows that it will be impossible to realize the production unless he adapts his methods to utilize them to capacity. Many men will study operation and use, and even improve upon what is expected through clever adaptation and handling.

The possibilities of studying the transportation departments of varying enterprises, gaining a sufficient knowledge of methods of operation to make analyses, hesitates to make a change, even though there be a probable aggregate saving shown in the estimate.

The Warren Bros. Company, known throughout the United States as a street paving contractor and affiliated with the Warren Bros. and the Warren Construction Company, has its executive offices in Boston, and its refinery and yard is in Potter street, Cambridge. The company has two asphalt refineries in California and the asphalt is shipped across the continent by rail and refined. The crushed stone is received in railroad cars, the cement by rail or vessel, and gravel is brought by barge from Long Island. This applies to the Boston plant. Wherever the company has contract for work such apparatus as is necessary is sent there and when this work is completed it is moved, so that in a considerable number of cities the firm may have for varying lengths of time construc-

tion gangs and tools and machinery necessary in whatever form of highway or sidewalk building may be undertaken. There are, of course, some plants that remain for considerable periods, but these are where the contracts are large. Usually such materials as are needed and may be secured at less expense are obtained as close to the work as is possible.

Where the plants have been located the haulage has been done with horses and carts contracted for, and this has been economical from the viewpoint of the limited time needed and the large expense for maintenance of animal equipment when not required. The Boston plant, however, is a permanent installation and the company has at Cambridge such facilities as are necessary in connection with street and sidewalk building and flooring and roofing. This has been developed to economically receive and store and prepare material for any work. For instance, the gravel received by barge is stored in large elevated bins or pockets from which the greater part will discharge by gravity, for the yard is on the water front. The car loads of asphalt are unloaded from a spur track in front of the yard. Car loads of crushed rock are brought over a subway and the stone dropped from the bottoms of these cars to smaller cars that are on an inclined cable railway in the subway. The cars are drawn to the top of a trestle and dumped into pockets or bins, or stored in piles under the trestle, and the sizes are kept separate. Cement is brought in by cars on the spur track.

The facilities at the yard have been briefly enumerated to indicate that where it is possible the company has equipment to expedite the handling of whatever material is kept in quantities, and during the busy season of the year these supplies are constantly arriving. The plant cannot be regarded as attractive save from the viewpoint of practicality, and while the methods might be considerably improved upon were a new yard to be equipped with the facilities that experience has demonstrated are desirable, it is doubtful if the economy resulting from a change in the present equipment would justify the increased investment that would be necessary. When the requirements of the business demand there is no reason to believe that anything else than improvement will be considered.

The principal operations of the company from the Cambridge refinery and yard are confined to what is known as the metropolitan district, which includes the city of Boston and the adjacent cities of Cambridge, Chelsea, Everett, Malden, Waltham, Newton and the towns of Brookline, Weston, Revere, Milton, Arlington, Dedham, Melrose, Watertown and Needham. Not all of these municipalities are covered by the company in its work, but it can be said that a radius of 10 miles from the centre of Boston will include the area in which the company makes contract for construction. The greater part of the work is probably within a radius of seven miles, but occasionally, if the contract is of sufficient proportions, it is undertaken as far as Lynn.

At greater distances contracts are made and a temporary plant is installed, so that it is not necessary to supply the material from the Cambridge yard, but for Boston and vicinity the surfacing is mixed and carted from that point. The reason the carting distance is limited is that it is necessary to have the material heated to a consistency that it can be worked, and at a reduced temperature it is not practical to use it. The bithulithic paving is a compound of crushed stone, gravel and asphalt, and this is laid on a foundation of crushed stone. Sometimes the company makes contract for the entire construction and at times merely the surfacing is provided. There is a variance in the character and quality of the work according to the uses to be made of it.

The construction can only be made when the weather is dry, and because this limits the period when work can be done it is necessary to have the haulage expeditious. When a street or sidewalk is excavated for the foundation course the lower course of stone is laid and consolidated by rollers, steam rollers up to 15 tons weight being used. The surface is next supplied and this must be prepared at the yard. The process of preparation is interesting. The necessary volume and size of crushed stone is specified and this is taken from the bin and is dried by a blast of heated air. It is carried by a bucket elevator, and after it is dry a given quantity of gravel is added and on this is poured asphalt heated until it is practically a liquid. This asphalt is a refined product and when it is liquified it must be to a specified temperature to have sufficient fluidity. But it can be destroyed by overheating. The stone, gravel and asphalt are placed in a mixing machine that revolves, and turned until the asphalt has thoroughly coated the solids, and then it is a mass with the voids completely filled with the bitumen. When mixed the material has a temperature considerably in excess of 300 degrees, and is loaded by gravity from the mixer, the vehicle being backed into a recess in the building that will receive a cart or truck with but little room above or at either side.

Much judgment must be exercised in the mixing of the material. The stone must be dry to insure the asphalt adhering to it, and there must be a sufficient volume of solids. The temperature must be such that the stone and gravel will not settle in the soft bitumen, and when the surfacing is delivered for use it must be of such a consistency that it can be laid evenly and have the desired proportions throughout. The surfacing is never sent away at a temperature of less than 300 degrees, and the workmen mixing the material generally work with thermometers to be certain that the heat is within the limits fixed. The mixture when prepared will cool very slowly, and it may be carried considerable distances without a sufficient loss of temperature to prohibit its use. If the material should harden slightly at the top, sides or bottom the bulk of it has a heat that will restore the cooled portion to a condition of usefulness by hand mixing, and even in cold weather, where the foundation has been protected against dampness, the surfacing may be laid.

Of course there is a standard of desired temperature

and when the material can be delivered at the job at this standard the most satisfactory work can be done. The time of cartage is a factor of considerable importance with reference to heat, and when received it is necessary that the material be spread as rapidly as is practicable. Once distributed the paving will cool quite rapidly. Obviously it is necessary to have a sufficient number of men at work on paving to handle the surfacing as it is delivered and when there is delay in cartage there is loss of time for the men, which the company must bear. A part of the system is to have the material mixed, hauled, delivered and laid so there will be a minimum of lost time, and with work in progress in several places careful judgment must be exercised.

With long experience a work is planned so that it can be completed with a given number of men, apparatus and tools and material and transportation, and the surfacing is mixed as it is required, the haulage being determined with a knowledge of conditions. At the yard at Cambridge the company kept 12 horses,

White Five-Ton Truck, Used for Paving Material Haulage, Loaded with Apparatus, Tools and Supplies for a Distant Construction Job.

these being worked in teams of two each. The material was hauled in Watson wagons of bottom dumping construction with a capacity of two cubic yards each, these loads weighing about three tons, which could be driven on to the work and the mixture dumped approximately where it was to be spread. Watson wagons were used because it is impossible to handle the paving material quickly unless dumped, and it cannot be shovelled or moved as can almost any other form of a load. Even with such equipment it was necessary to use more or less force in dumping when the material cooled slightly. Where the work was of sufficient proportions, such as a street, where from 800 to 1000 yards of surface could be laid a day, it was necessary to hire additional horses and the wagons were operated wherever possible with a headway of about 10 minutes, this affording a supply that could be advantageously worked by the paving gang.

But while this theory was the basis of estimate when contract was made, it was found in experience that there were numerous delays with the animals, and this lost time represented a considerable amount of money when the total was even approximated. Besides this, if the wagons did not arrive at the yard in regular order the material could not be worked to advantage, for the mixing machine could not be filled with fresh stock until dumped. Were the elevator and mixer to be built again to meet the requirements for the greatest economy it would be with facilities for dumping the mixer and keeping it at work, so that a load or two might be in readiness if there were delay of the vehicles, and the carts could be loaded without waiting whenever they reached the yard. But to make this change would entail a comparatively large expense, and it was believed best to endeavor to maintain the wagons as near a schedule as possible, rather than have an investment that would not be always productive. In other words the company had to choose between the loss through delay of the wagons and men or install facilities that would necessarily be idle a part of the time. The choice was to continue the use of the mixer.

The work of the company is usually carried on with a foreman or superintendent in charge of each job, and the yard, which is in charge of Supt. Sutcliffe, is expected to deliver the material, tools and supplies wherever these may be required. Naturally the number of jobs varies and at times it is necessary to send surfacing considerable distances. The longest distance that material has been supplied from Cambridge by horse wagon is Lynn, and with the work beginning at 7 in the morning and a four-hour haul for the horses, it was necessary to start with the first loads at 1 at night, and one round trip was a day's work for the animals and drivers. More or less work is done before and after the usual working hours of the day, especially at the season of the year when conditions are favorable for outdoor construction. As the paving material must be delivered mornings when the gangs are ready for work it will be understood that the demands are dependent upon the distance from the yard, and the hours for the yard gang and the drivers are governed by circumstances. But the purpose is to supply every need promptly, which means occasionally, at least, long days and hard work.

About two years ago Supt. Sutcliffe, who is also traffic manager for the company, began to investigate the possibilities of motor trucks and wagons and after a period of continued observation and careful study of the uses of machines in service that was somewhat similar to his own he prepared estimates of what he

believed could be accomplished with the facilities he had. He was conservative in his deductions and he decided that a five-ton truck must earn $15 a day to be preferable to animal vehicles. He had at the yard a machine shop with a working force of about 25 men and resources for practical work, which was an advantage insofar as maintenance was concerned, and he knew from experience with machinery the necessity of consistent and careful upkeep. There was a reasonably satisfactory building available for a garage and he believed that with practically little change he could make advantageous use of trucks. The analysis was submitted to the company, but the officials were not at that time ready to make the change.

Last spring the company called upon him for an opinion as to what might be done with trucks and though he had continued his observation and investigation he did not believe that he was justified in changing his original estimates. These were submitted and, after consideration, the company authorized the purchase of two five-ton trucks and a 3000-pound wagon, this being regarded as equal to the enimal equipment. White machines were ordered and delivered about the first of July, the trucks being fitted with special bodies that are practically shallow steel pans 11 feet length, six feet width and 18 inches depth, having a capacity of 100 cubic feet, which is approximately equal to five tons, for the paving mixture weighs about 100 pounds to the cubic foot. Both trucks are equipped with the White power hoist and the bodies may be elevated to an angle of 45 degrees, which inclination is necessary to dump the surfacing material. The tail boards of the bodies may be entirely removed to permit the complete clearance of the load. But when the trucks were received it was decided to adapt what is known as a caravan or stake platform body to them, that they might be used for other forms of haulage when not needed for paving. In 1912 the company's paving work continued to Jan. 1, and it will be resumed as soon as the highways dry sufficiently, perhaps in May, but there is more or less repairing that may be done much earlier. During this comparatively inactive period it was believed that other uses could be made of the machines. The 3000-pound wagon was equipped with a regular stake platform body. This was fitted with single and dual pneumatic tires.

The company utilized the trucks as it had its horses and carts and adapted several of its Watson bottom dumping wagons as trailers. This was done by fitting a drawbar about three feet long that took the place of the wagon pole, and in the end of this wooden pole was a slot several inches in length. The pole end was secured to the centre of the rear chassis frame member by a pin dropped through the slot in the pole end, and chains were extended from the ends of the equalizer mounted under the extension that carried the pole to the ends of the side members of the chassis frame. The slot permitted the pole to go forward sufficiently to attach the chains, and by the pole the trailer was steered. The chains and the equalizer gave absolutely good control.

In the use of the trailers not a little difficulty was experienced through the difference in the angle required for rubber and steel tires to lift from the grooves of or from within car tracks. The rubber, having much better traction, would lift at a comparatively slight angle, but the steel would not rise until a much greater inclination had been given the wheels. When the wagons were first used as trailers the drivers of the trucks turned from car tracks and the trailer wheels did not lift. The result was that the trucks continued on, the driver perhaps unconscious that the trailer was left behind with a wheel or two and the pole and the chains broken. Such accidents were frequent until the drivers learned more of handling the truck with a trailer, but this was largely due to the fact that the wagons were not and cannot be effectively adapted for the purposes because they are too lightly built and have too high a centre of gravity.

Dumping the Heated Paving Mixture on the Job at a Temperature of About 300 Degrees, Ready for Quick Laying.

With a truck and trailer loaded eight tons of surfacing could be carried at a single trip, and it was Supt. Sutcliffe's observation that it required but little if any more time for loading and unloading, for a trailer could be loaded while the truck was away and be ready for coupling as soon as the truck was loaded, while both could be dumped at once on the job. He found the trucks could be depended to work to a schedule and there was but little variance in time of trips, which was important for the mixing gang, and that practically the only reason for delay was when worked in combination with animal carts, for the truck equip-

ment was not sufficient during the busy periods. The truck he found to be equal to at least three horse wagons, and under some circumstances to four, and with the trailer added this brought the work to that of five or more wagons. Of course the capacity was somewhat dependent upon the length of haul. Besides the trailer wagons could be used for hauling the small portable furnaces used for heating material for repairing, tools, and, in fact, any supply that was needed. This was without loss of the usual load of paving and was a distinct saving of time as compared with horse work.

From time to time, when necessary, the trucks were sent away on jobs a considerable distance, at one time to Haverhill, 38 miles from Boston, where they were worked from the temporary plant located in that city. The trucks carried loads of tools and equipment both ways, which was a saving of the freight, as well as having the use of these without delay. Not only this, the company had the benefit of the trucks on the contract, doing the work at Boston with horses during the time the machines were away.

The 3000-pound wagon was given the work for which two horses and two single express wagons were used. One of the wagons made daily trips about Boston, taking a half day for a round of collections, and this has been reduced to an hour and a half with the motor outfit. The delivery of small orders, sending out material or tools needed for the floor and roofing jobs and the like, taking practically the remainder of the time.

In fitting the trucks for the installation of caravan bodies it was found necessary to remove the power hoist body trunnions and the mechanisms and fittings assembled with the chassis frame and to mount these on a heavy frame of six-inch steel channel, exactly as on the chassis originally. The frames are so constructed that they are bolted on the chassis, raising the bodies six inches above the normal height. When desired the bodies are lifted with the frames from the chassis, leaving the hoisting mechanism without change, and these were replaced with the caravan bodies, the work being done by derricks and with very little labor. This dual body installation has worked out very satisfactorily from every point of view.

Supt. Sutcliffe says that he has kept careful record of his trucks and the work performed with them, but points out that it is impossible to demonstrate efficiency by mere cost figures because the conditions with reference to work cannot well be averaged, even with one equipment. Not only this, there are so many variable factors and service that cannot be shown in its actual value, that no positive standard of worth to others can be given. He estimates that a five-ton truck will replace three and sometimes four two-horse teams and wagons, and when used with trailers five and possibly six, according to the character of the work and the distance, and says that this might be improved upon with a change of yard facilities that would entail a considerable investment. He maintains that a truck of this size must earn $15 a day to make it profitable, or really to pay for itself, and says that with his work this figure is justified by experience. After six months' service he went over his records carefully and found that he had accomplished a saving of approximately 33 per cent.

He had a well kept record of horse cost for the 18 months prior to the installation of the trucks, and very good figures for a considerable period before, and his statement is based on accurate knowledge. Rather surprisingly, he states that from his first half year's experience he has had no reason to change his original estimate of the value of trucks to the company, and that his first figures are, to his mind, absolutely well founded. He has allowed for an overhaul of the machines in this statement as well, for this work is to be done during the time of least activity of the work.

The company has ordered a third five-ton truck, which will be delivered before the opening of the season, and this will be similarly equipped with regard to the body. The horse equipment has been disposed of save two animals that are used in yard haulage and are being kept until the price set upon them is offered.

Relative to depreciation and maintenance, Mr. Sutcliffe believes that a truck ought to endure as does other machinery, provided it receives the necessary attention and is protected, and with his facilities he proposes to minimize expense and insure endurance by systematic care. The men driving the truck were horse drivers and have proven themselves efficient and capable. One of the best machine shop mechanics has been assigned to the work on the machines and is assisted by the drivers, who are in this manner acquiring practical knowledge that will be very useful.

The transportation department of the Warren Bros. Company is operated with a view of economizing from every practical viewpoint, but the machines are never sent out overloaded and they are not worked when a repair should be made. Supt. Sutcliffe says that it is cheaper to do repairing when its need is known and not take a chance in causing damage through neglect.

KISSELKAR SAVES TOWN.

Hauls Fire Apparatus from Neighboring City 14 Miles in 48 Minutes.

To the fact that Harry A. Fish, a miller of Woodbury, N. J., is the owner of a three-ton KisselKar truck, the village of Swedesboro owes its existence. Swedesboro, which is situated 14 miles from Woodbury, was threatened by a serious fire when an appeal for help was made to the fire department at Woodbury.

A hasty consideration of the request convinced the Woodbury chief that it would be folly to attempt to drive with horses with any hope of reaching the scene in time to be of any service. Mr. Fish's truck was thought of and was pressed into service. It hauled the apparatus and 25 men to Swedesboro in 48 minutes, arriving in time to prevent a conflagration.

PEERLESS TRUCK HAULS PERRY MEMORIAL.

THERE is national interest in the monument that is to be erected to the honor of Oliver Hazard Perry, the Rhode Island naval hero, and which is to be dedicated on Sept. 10, at Put-In Bay, Ohio. It was in this bay that the youthful officer fought the historic engagement that was crowned by his victory and the elimination of English jurisdiction so far as its navy was concerned from the water of Lake Erie and from the Great Lakes. The monument is a tribute of the nation, and in the formalities that will take place on the centennial of this memorable conflict, fought Sept. 10, 1813, practically all of the states of the Union will participate by representation. The occasion will attract many thousands of people and in many of the states the day of dedication will be a special holiday.

At Erie, Penn., the hulk of the Niagara, to which Perry transferred his flag when he abandoned his sinking flagship, and which was raised from beneath the waters of Misery Bay after nearly a century's submersion, is being repaired and made ready for a cruise in Lake Erie the coming summer. And in the town of Milford, Mass., the Massachusetts Pink Granite Company is hewing from its quarry the stone with which the imposing base and shaft of the Perry monument will be built. The Niagara will, no doubt, be an object of keenest interest for a comparatively brief period, but it is expected that the monument will be as enduring as are the rugged hills from which its granite blocks have been wrested.

Four-Ton Peerless Truck Hauling Rough Blocks of Stone for Commodore Perry Memorial at the Quarry of the Massachusetts Pink Granite Company, Milford, Mass.

The quarry of the Massachusetts Pink Granite Company is high on a commanding eminence, for on the crest of this hill is found the finest quality of stone. Here the solid rock has been exposed, and the quarrymen with drill and explosive break out blocks that are as near the shape required as they can be loosened. For years the company has carried on business, and the rough stone from the quarry has been hauled two miles to the works, where it is shaped and dressed. The works are in a valley and were so located to be at the railroad, for practically all of its stone is shipped, but it is impossible to get the tracks nearer the quarry save at an expense that would be prohibitive.

It might be possible to construct a railroad that would bring the stone down by gravity, but it would require very certain power to even draw back the empty cars. The business of the company is constant and dependable, but even the building of a road from the quarry to the works has never been considered, because of the expense, and so the rough stone has been hauled the two miles by horses and on heavy carts whenever the conditions would permit. Between the quarry and the works there is a cart path, and despite the fact there is a gradual descent never less than four and sometimes six horses were used, and two round trips could be made in a day. The carts were fitted with brakes and these were at times necessary because of the irregular character of the path, which has extremely sharp descents. There is but one stretch of the way that the horses climbed a grade while going from the quarry to the works, and were there much work of this kind the teams used would need be of at least six horses under the most favorable conditions, and perhaps as many as 10 would be necessary during storms and when the ground is wet and soft.

Now the company has a five-ton Peerless truck doing the work that was done by horses. Not only this, but it is doing it well, and under conditions that are about as unfavorable as could be experienced. The machine is kept at the works and day after day it is climbing the hill to the quarry and bringing down blocks that are to make the Perry monument. These blocks when dressed and finished weigh 4.5 tons, and when rough quarried they will range in weight from 11,000 to 12,000 pounds. The stone is blasted in the quarry and then raised by derricks. The truck is backed under them and the granite is lowered carefully. Then it is hauled to the works and there lifted from the truck by derricks.

The rock is then dressed and when finished it is lifted on to flat cars and shipped. The handling requires considerable time, both at the quarry and at the works, and the trips cannot be quickly made because of the loads carried and the condition of the path. The driver of the truck, a thoroughly experi-

enced man, says that the road is the worst he has ever driven over, and he believes himself qualified to judge. He has hauled chip stone, cinders, gravel and the like from the works and filled some of the worst places in the path, but despite this the road is but little better. for, there are places where water accumulates and will not be dry before the late spring. It would require months for a good sized gang of men to make the path anything like even an ordinary country way.

Over this the truck is making eight trips daily, a distance of approximately 32 miles, and is delivering four times as many blocks as could be hauled with a team of four horses, and doing it well. If the path had been even levelled there would be a decided gain in time, for the grades are such as to cause very hard work. As might be imagined the horses and carts have cut the road until the ruts are almost axle deep. The driver says that if he has time he can carry enough material to fill the holes, and that it may be he will level the surface of the path so that it may be regarded as passable. But it will be an undertaking of no small proportions. He maintains that this is the only truck in use that is used for haulage and private road building.

So far as the economy of the machine is concerned its work is evident. Just what the cost will be as compared with horses cannot be determined until after a service of considerable length and an accurate knowledge of cost, but this will need be placed against the decidedly uncertain expense of horses. Expedition in getting the Perry monument stock out and finished was what prompted the use of the machine, and according to the observations of the officers of the company the memorial will be quite as important in its affairs as it will be to the people of the nation, marking, as it does, a great progression in business development.

OVERLAND DELIVERS MILK.

Capacity of the Horse Drawn Equipment Has Been Increased Five Times.

A dairy company of which Col. George H. Pippy of San Francisco is the head, has put in service an Overland delivery wagon, made by the Willys-Overland Company, Toledo, O. While the car was purchased to advance the business interests of the firm, the acquirement of the machine also has a humane side to it. It is being exclusively used to deliver certified milk. The law of California requires that certified milk must be delivered as soon as possible after reaching San Francisco.

The Overland delivery wagon meets the milk at the depot and within five minutes after its arrival it is on the way to the consumers. The success with the first motor wagon used has been shown by the increased demand for certified milk and now, instead of the shipments being limited to the capacity of the horse delivery wagon, they have been increased five times by the new means of transportation.

TO OPERATE STAGE LINE.

Spokane Man Organizes Company to Compete with Railroad Transportation in Washington State.

Convinced by a short experience with an automobile stage line from Spokane to Reardan, Wash., a distance of 24 miles, that good roads allow actual competition with railroads, H. S. Hawley states that he is planning the organization of a $100,000 corporation to handle business on a larger scale. Among the things that the new corporation plans to do are the following:

Replace the present stage with several interurban road motor cars of an advanced design, similar to an ordinary railroad coach; extend the present service to Davenport, Wash., as soon as Lincoln county extends its stretch of permanent highway from Reardan to Davenport, and handle not only passenger and express business, as at present, but also a line of fast freight. Mr. Hawley makes the run between Reardan and Spokane in 1.5 hours.

ANOTHER UNIVERSAL FACTORY.

Detroit Concern Secures Additional Capital and Will Materially Increase Production Facilities.

Fred K. Parke, secretary, treasurer and general manager of the Universal Motor Truck Company, Detroit, maker of Universal trucks, has announced that the company has been incorporated under the laws of Delaware, the capital being $1,200,000, of which $500,000 is preferred and $700,000 is common. All stock has been sold and work will be begun at once on the erection of a factory quite as large as the present plant.

The new building will adjoin the old one, the company having owned the entire square block of property since its organization. It will cost $250,000 without the machinery. According to Mr. Parke the Universal company will soon be one of the largest concerns in the world producing commercial vehicles and as the business increases other additions will be made.

NEW TRUCK FROM ST. LOUIS.

Plans Completed for Production of Light Delivery Vehicles and Farm Tractors.

The Admiral Motor Company will soon begin manufacturing operations at St. Louis, Mo., it is stated, and Don E. Evans, now acting sales manager for the Alma Manufacturing Company, St. Louis, will act as general manager for the new concern, which is expected to produce an approved type of motor truck.

The vehicle will be a 1000-pound wagon. Work will be started with about a dozen men, it is said, but the force and output will soon be increased. A light farm tractor will also be manufactured. It is stated that citizens of St. Louis already have subscribed for $10,000 of preferred stock, the total capital being $60,000.

NEW LINES AND BIG BUSINESS AT CHICAGO.

FROM the viewpoint of the exhibitors the second part of the Chicago motor vehicle show was in every way complete. The number of displays was larger than in previous years and a very satisfactory business was transacted by practically all of those who participated, at least so far as wagons and trucks were concerned, but there was comparatively little realization from the extra week by those who showed else than machines. This, however, had been the experience of those who have made display in shows of two weeks' duration, and yet, from the attitude of those who deal in cars, wagons and trucks, the segregation of vehicle exhibits had been beneficial in that it permitted undivided attention to those interested in either classification.

There were in all 76 different exhibitors, but of these one showed three different makes, two showed two, and two others both electric and gasoline vehicles, which made a total of 81 different machines exhibited. Of these 24 makes were not shown at New York, and 14 showed entirely new constructions, either in the form of an addition to the line produced or a design not previously exhibited. If there was one fact more than another impressed upon the visitor it was the number of what may be termed the lighter and smaller vehicles, which have been developed with special reference to the demands of the market as experienced by the western builders. The large and heavy machines brought out the past year are comparatively few in number, and seemingly there has been a disposition by many to build what will meet the requirements of the business men who have need for comparatively fast machines.

Twelve of those who exhibited at New York were not represented at Chicago, and adding these to the exhibitors at the Windy City this makes a total of more than 90 different makers who had displays at both shows, which is about a third of the number included in the industry. So it may be said that while the aggregate of makes seen at the two shows is a minority of the makes produced in this country, so far as production is concerned these exhibitors make a very large percentage of the vehicles built in America at the present time.

In examining the power wagons one is impelled to note that there has been no disposition as a whole to depart from conventional practise. To the contrary the majority of the designers have sought to improve by development of the types that have been worked out and well tried in service. There has been and now is a belief that it is best to perfect one or more designs instead of rejecting what has been brought to a known standard of efficiency, and to depend upon consistent development through practical experience. The policy of producing but one machine has been followed by a number of the makers who did not make a showing at New York, and while it is probable that some of these will add to their line of models later on it appears that the belief that specialization is best has been very generally approved. There are makers who assume that the larger the number of sizes built the more the varying demands can be met, but as this policy necessitates increased manufacturing facilities and proportionate expense it has not met the approval of those who believe in the possibilities of specializing.


View of the Coliseum Main Floor During the Commercial Vehicle Show at Chicago.

While the New York show was especially interesting from the number of developments, there being approximately 40 new vehicles displayed there, but comparatively little was seen at Chicago that was not shown at the Metropolis. For instance, the only new worm driven vehicle brought out was the 3000-pound Diamond T delivery wagon, and aside from the use of the Wayne gearless differential in the Ideal wagons all else was to conventional design and practise. In fact one of the surprises was that there were so few really new constructions displayed.

While eight different vehicles are built in Chicago, all of the makers appeared to believe that it would be best to reserve their exploitation for the West, instead of the East, and while not one of these was

shown at New York all made an admirable display at the Coliseum. The reason for this apparent indifference may be the fact that the manufacturers regard the possibilities of the West with greater favor than the East, a supposition borne out by the character of the exhibitions made.

The Adams Bros. Company, Findlay, O., showed a new two-ton wagon, this being the largest size this company has yet built. It does not differ materially from the smaller machines in general design, and is built entirely by the makers. The motor is a four-cylinder, water-cooled, L head type with the cylinders cast en bloc. The bore is 3.875 inches and the stroke five inches, giving a rating of 24 horsepower. The valves are at the right side of the motor. The crankcase is of aluminum and so constructed that the lower section, containing the oil reservoir, may be removed without loosening the main bearings. The motor is cooled by a centrifugal pump and a vertical tube radiator, the air being drawn through the radiator that is back of the engine and expelled from beneath the hood by the fan-bladed flywheel. The lubrication is by splash in a constant level of oil maintained by a gear driven pump.

A Corner of the Chicago Truck Show from in Front of the Adams Exhibit.

The ignition is a dual system, with high-tension magneto. The clutch is a multiple disc type and the transmission gearset is a selective sliding gear type having three forward speeds and reverse. The gearset case and the jackshaft housing are assembled as a unit and the jackshaft is mounted in the hangers, which also carry the front ends of the rear springs. The drive is by side chains.

The showing of Avery vehicles, made by the Avery Company, Peoria, Ill., was a one-ton wagon known as type C, in which the driver is seated back of the motor, and two, three and five-ton sizes of type B, in which the motor is under the footboards. The type A machines are with the driver's seat and control members beside the motor, these now being made in the three-ton size only. The motor of the one-ton wagon is cast en bloc with bore of 4.125 and stroke of 5.25 inches. The engine used in the two-ton wagon and three-ton truck has cylinders cast separately, with bore of 4.75 and stroke of five inches. The motor of the five-ton truck has cylinders cast in pairs with bore of 4.75 inches and stroke of 6.75 inches.

The Clark Delivery Wagon Company, Chicago, Ill., has discontinued the use of the double-opposed cylinder motor and all models are now equipped with four-cylinder engines having bore of 3.75 inches and stroke of five inches. The transmission gearset is selective, with three forward speeds and reverse, and by the use of jaw clutches the gears are constantly in mesh. These machines are built with the driver's seat behind or above the motor.

The Diamond T Motor Car Company, Chicago, Ill., displayed a 3000-pound wagon that has a motor with bore of 4.125 and stroke of 5.25 inches, the cylinders cast en bloc, and the clutch and gearset are assembled with the power plant. The ignition is by a high-tension magneto and a fixed spark. The drive is by worm. The company makes a machine of three tons capacity with a motor having bore of five inches and stroke of 5.5 inches, which is also worm driven. A five-ton truck, driven by chains, has the same size motor as has the three-ton machine.

The 3000 and 6000-pound machines built by the Four Wheel Auto Company, Clintonville, Wis., were shown for the first time. These vehicles have not been changed since they were first placed in the market, but they were entirely new to the visitors. This design drives all four wheels by shafts and bevel gears, the forward wheel driving shafts being fitted with universal joints that give steering control by conventional means.

The Harder Auto-Truck Company, Chicago, Ill., showed for the first time a 2000-pound delivery wagon that has a four-cylinder motor with bore and stroke of four inches, a gearset giving three forward speeds and reverse, and driving by side chains. The radiator is mounted on springs and is designed to swing to give access to the motor. There is an auxiliary spring mounted at the rear. The wheelbase is 112 inches. The wheels are fitted with 36 by four-inch solid tires.

The Harvey Motor Truck Works, Harvey, Ill., showed for the first time the 3000-pound Harvey wagon, which has a four-cylinder, en bloc motor, with bore of 3.75 inches and stroke of 5.5 inches. The wheelbase is 130 inches. The construction throughout is conventional save the wheels, which are die cast steel, and are claimed to have unusual strength and longevity. This is the lightest machine of the four American makes to use such equipment, the other vehicles on which they are used being the Locomobile, Smith-Milwaukee and White trucks.

The Hercules 2000-pound delivery wagon was

shown by the Maxwell Motor Company, Inc., this being a product of the Flanders Manufacturing Company, Detroit, Mich. This is made in two types, with the seat behind the motor and with left side drive, and the other with the seat above the motor and right side drive. It is built of standard components, having a Continental engine, a Brown-Lipe transmission gearset, a Sheldon jackshaft, Bosch magneto and Schebler carburetor. The engine under the hood type has 130-inch wheelbase and the other 110-inch wheelbase.

The Ideal Auto Company, Fort Wayne, Ind., showed a new 4000-pound wagon known as model K, which has the same general design as other machines of this make, the Wayne gearless differential being used instead of the conventional bevel gear. The motor is a Continental en bloc, having bore of 4.125 inches and stroke of 5.25 inches, rated at 35 horsepower.

The Thomas B. Jeffery Company, Kenosha, Wis., displayed three machines, the one being an adaptation of the pleasure vehicle chassis with a delivery wagon body, having a capacity of 1000 pounds. The others are one and two-ton wagons, the larger having an electric starter. The motor is the same for all three machines, having four cylinders and 4.5-inch bore and five-inch stroke.

The Chicago Pneumatic Tool Company, Chicago, Ill., showed the 2000-pound model D Little Giant delivery wagon that was developed early in 1912 and is continued without change. This machine has a double-opposed motor under the forward section of the body, and a planetary transmission. The wheelbase is 91 inches. Another type of the same capacity has 110-inch wheelbase and a selective type of gearset with three forward speeds and reverse. The two-ton model has the same wheelbase and a four-cylinder motor.

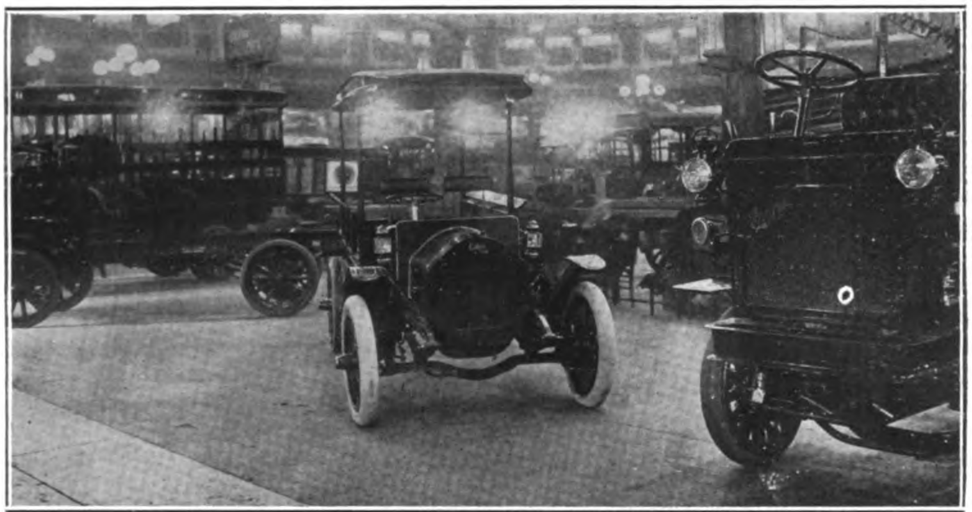
The Moon Motor Car Company, St. Louis, Mo., builds two machines, the one of 1000 and the other of 3000 pounds capacity, the latter being shown. This is equipped with a four-cylinder, water-cooled, en bloc motor of 35 horsepower and the drive is through a gearset giving three forward speeds and reverse to a jackshaft and thence by side chains.

Menominee delivery wagons of 1500, 2000 and 3000 pounds capacity, were exhibited by D. F. Poyer & Co., Menominee, Mich., and were seen for the first time at a show. The feature of these machines is the gear reduction and the straight line drive. The power plant is a unit type, and at the rear of the gearset case on the main shaft is mounted a pinion that meshes with a gear below it, which in turns drives the driving shaft, which is suspended so low that there is no inclination whatever when the chassis is under load.

The Mogul Motor Truck Company, Inc., Chicago, Ill., which last year built two, four and six-ton sizes, has for 1913 added three and five-ton machines. The L head en bloc motor of the two-ton chassis has a bore of 4.125 inches and stroke of 5.25 inches. A selective gearset is used with this construction. The three and four-ton chassis have motors with bore of five inches and stroke of 5.75 inches, and are equipped with progressive gearsets. The five and six-ton chassis have motors with bore of 5.25 inches and stroke of 5.75 inches and have progressive gearsets. On the three largest sizes dual ignition is used.

The Moore 1600-pound delivery wagon, built by the Palmer-Moore Company, Syracuse, N. Y., exhibited at the show, is fitted with a three-cylinder, air-cooled, two-cycle motor, which has variable ports and for which great efficiency is claimed. The motor is fitted with a fan-bladed flywheel, which effectually cools it. Another feature is a planetary driving system in which when one speed is set the others are automatically released.

The Old Reliable Motor Truck Company, Chicago, Ill., made display of the new three-ton truck, which has a four-cylinder, T head motor with bore of 4.25 inches and stroke of five inches. The design follows the five-ton machine, but its wheelbase is 120 inches.



A Glimpse of the Coliseum Main Floor from the Gramm Stand.

No change has been made in the Commerce, Sampson and United States wagons and trucks, while the Walker electric design remains the same. The Urban electric vehicles, built by the Kentucky Wagon Manufacturing Company, are conventional in design and the Buffalo Electric Vehicle Company is producing a 1500-pound wagon that is driven by shaft direct from the motor to the differential in the floating rear axle.

Not a little attention was directed by the builders of large machines to special bodies and devices for facilitating loading and unloading, and of these the majority were seen at New York. Several bodies were fitted with rollers for the handling of lumber, and there were numerous machines equipped with dumping bodies, these being adapted for more general service, especially for construction work. Power and manually operated hoists were very frequently used

and the majority of the former type were, because of their weight, seen on the heavy machines.

The bodies built for different classes of work, that is, for specific purposes, were exceedingly numerous, and some of these were admirable specimens of wood working and finishing. The delivery wagons as a rule were designed with keen realization of the possibilities of appearance as well as utility, and while intended for show purposes were practically all to be delivered as quickly as possible following the exhibition.

The show of accessories, supplies, equipment, etc., was large and complete, no less than 140 different firms being represented during the week.

GRAMMS IN THE PHILIPPINES.

One Concern Operates Fleet of Twenty with Satisfactory Results Despite Road Conditions.

Eight Gramm trucks recently left the plant of the Gramm Motor Truck Company, Lima, O., on journeys which will take them more than half way around the globe. Six of the vehicles were consigned to a contracting firm at Manila, Philippine Islands, and the remaining two go to Australian customers. The Manila shipment left the United States from San Francisco, while the other went from New York City.

The Gramm company has built up a good trade for its trucks in Manila, one firm now operating a fleet of more than 20. The vehicles are giving excellent satisfaction in transporting building materials and supplies, as well as regular merchandise over the type of roads to be found on the Island of Luzon.

BUYS TEN ADAMS TRUCKS.

Newark Gas Company Files Large Repeat Order After Extended Trial in Service.

The Public Service Gas Company of Newark, N. J., has placed a large repeat order with the Adams Bros. Company, Findlay, O., for 10 one-ton Adams trucks which were especially designed for the Public Service Gas Company's use. While the chassis are of standard type, the bodies are with a view to facilitating the handling of long lengths of pipe.

The purchase of the Adams trucks was the result of two years of testing by the gas company, which furnished data of extreme importance to prospective motor truck users, owing to the fact that the company not only kept an accurate record of the work done by each vehicle and the cost of operation, but was able to detail special men to devote their attention to the subject and who were trained engineers. In giving its order the Newark company places its seal of approval on the motor driven truck, both from the standpoint of economy and efficiency. It has proved the economy of the mechanical transport despite the fact that it writes off a depreciation of 50 per cent. a year on all motor vehicles.

KISSEL IN MOVING WORK.

Saves Householder Substantial Sum, Besides Eliminates Necessity for Repeated Handling.

A three-ton KisselKar truck, made by the Kissel Motor Car Company, Hartford, Wis., and owned by an express and teaming company of Chicago, recently transported a 5500-pound load of household effects from 1549 Northwestern avenue, Chicago, to 35th and Vliet street, Milwaukee, Wis., and returned home in the actual round trip running time of 36 hours. The trip was nearly 100 miles over rough and snow blocked roads and the truck proved itself not a mere competitor and successor of the horse, but a new element in transportation.

It was asserted that the trip was undertaken as a measure of economy and the owner of the goods was saved between $40 and $50. Had the goods been shipped in the usual way, the owner calculates he would have had to meet the following expenses: Crating, loading and hauling the goods to railroad terminal, freight charges to Milwaukee, unloading and haulage in Milwaukee and uncrating at destination. In using the truck the goods were handled but once in loading and once in unloading, and did not require expert packing in material or men.

PERU SECURES ANOTHER CONCERN.

Will H. Brown Instrumental in Locating Accessory Manufacturer in That City.

The Crum-Wiley Manufacturing Company, which has been enjoying a great increase of business the past year, has been induced to locate at Peru, Ind., through the efforts of Will H. Brown and the directors of his company, the Brown Commercial Car Company, Peru, Ind. It will manufacture all automobile accessories made in brass, its specialty being grease cups and other small parts used in the building of motor vehicles.

Besides Mr. Brown the directors of the new concern are the following: President E. L. Crum, Vice President Max Krauss, Secretary-Treasurer S. A. Shesler and J. R. Woodring. The company was formerly located at Decatur, Ill., but was moved to Peru when that city offered a factory site and the citizens purchased stock. A new fireproof building of brick, steel and glass will be erected and the plant will be in operation in a few weeks. In addition to the Brown Commercial Car Company, of which he is president, Mr. Brown is connected with the Peru Castings & Machine Company, which does all the foundry work for the Brown company.

Grand Rapids Buys White—Grand Rapids, Mich., has purchased a White hose and chemical wagon, made by the White Company, Cleveland, O., and it is proposed that other additions of a similar nature will be made in the near future.

LEARNING COST FROM ACTUAL SERVICE.

Staples Coal Company, Boston, Mass., Operates Gasoline Trucks for Long Hauls and Electric Carts Against Horse Work to Determine Transportation Economy.

THE transportation department of a coal dealer often represents a large sum, and with concerns doing a business of considerable proportions the investment represented by the necessary equipment is frequently no small part of the entire capitalization. The delivery of the coal is necessary with a very large part of the total tonnage sold, for comparatively few customers will haul their fuel, it being generally believed that this can be done cheaper by the dealers with special facilities. Frequently consumers will place orders of such size that daily cartage is necessary, based on the lowest price quoted for a specified quality, and sometimes contracts are based on bids submitted by the dealers in competition, but aside from these the sales are usually made with stated charges for delivery in zones of about a mile each from the yard added to the established yard prices. Custom has fixed the delivery charge at approximately 25 cents a mile a ton for all distances up to four miles, and that is about the distance that an average dealer will expect to attract patronage, because he will enter into competition with other firms having prices similarly based, making delivery under conditions assumedly under like circumstances and conditions.

This may be applied generally, and it can be stated that this restriction of patronage by delivery charges and competition is probably the average experience, but it is also a fact that concerns of large proportions having contracts and the like will require haulage considerably beyond the distances customarily regarded as the delivery limits. Though this volume of business may not be sufficient to justify stimulating, there may be many reasons why it should not be neglected, and many firms make deliveries comparatively long distances from the yards.

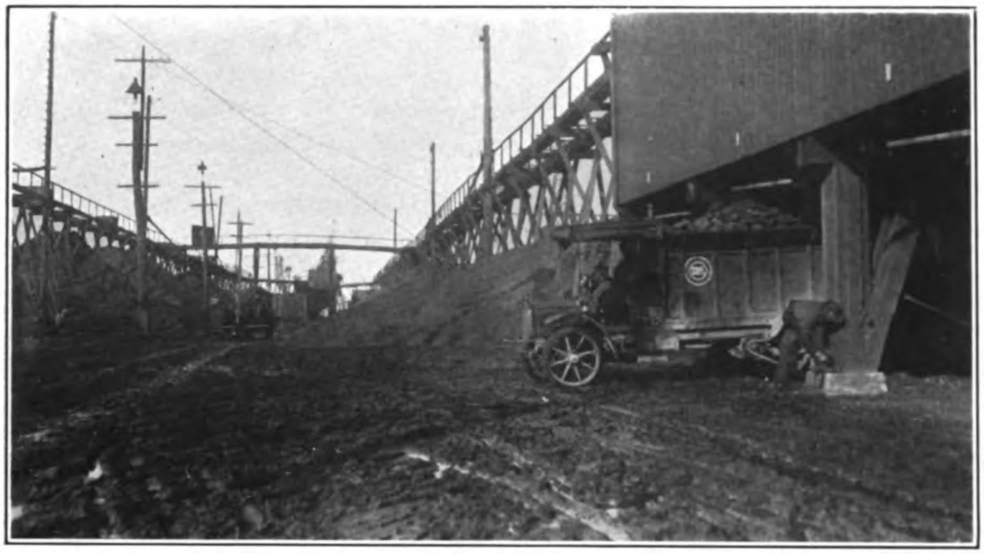
While it is certain enough that the charges made for delivery have been made by custom rather than by any definite knowledge of the actual cost, and it is probable that most coal dealers believe that they have to consider the average rather than the specific expense, it is fair to assume that whatever difference there was between cost and delivery charge when rates were established have been materially reduced, if not wiped out, by the increased expense, provided that this item was not considered in the general raising of yard prices. While no statement has ever been made as to this detail, it is a fact that the delivery charge has been maintained without regard to the variance in coal cost.

It is not possible to estimate with accuracy what a delivery equipment will accomplish. In cities like Boston a single horse may be depended upon to haul or handle from 5.5 to six tons of coal a day, averaged through the year, and it is not improbable that it will be nearer the lower than the higher figure. In smaller cities, where the hauls would average shorter distances and the customers within a relatively smaller area, it is possible that the average delivery made by a single horse under favorable street and topographical conditions might run as high as seven tons, but it would be far from conservatism to accept that figure. Considering haulage as a whole even six tons would appear to be more than a reasonable average standard.

White Truck Leaving Summer Street Yard After Weighing for a Long Trip, with the Following Horse Cart Starting on a Short Haul.

The average daily mileage of a horse may be placed at 15, though in some service this may be exceeded. The estimate ranges from 14 to 16, and considering humane working of animals and conserving their usefulness and value the figure stated is reasonable. Where a delivery service is of considerable size it is usually believed to be prudent to have extra horses, and one spare animal for every 10 is not an injudicious ratio when constant and undiminished work is necessary.

Reference has been made to the work in tonnage moved and miles travelled because they are practically



Loading the White Truck Equipped with Dumping Body at the Anthracite Coal Pocket, the Equipment Having the Advantage of Quick Loading and Unloading.

the only data to be depended upon, for costs will differ with conditions and administration. But this gives a foundation of work performed and on which cost may be fairly approximated. The delivery may be one or more long hauls or numerous short hauls, and by this standard the work capacity of any number of animals may be approximated. But while this standard will not be exceeded save during exceptional demands, it follows that when it is not realized there is not only loss, but the cost of the delivery made has been increased.

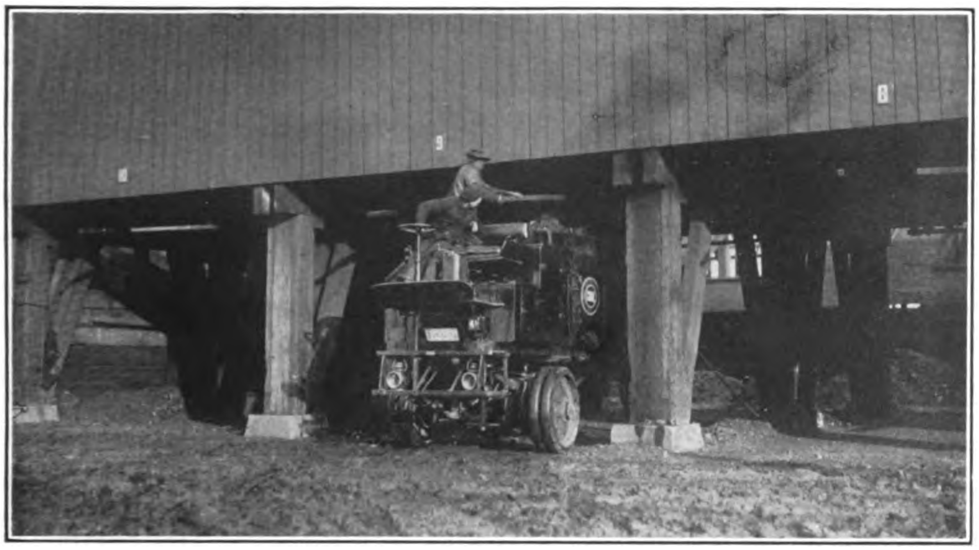
The statements with reference to delivery cost and work capacity of horses has been made to demonstrate that coal haulage is not based on actual figures and comparatively few concerns, even those having splendid accounting systems, can show that operating cost is the actual basis of delivery charges. This being so, it is evident that conclusions made as to delivery operating expenses must be founded on observation, or experience, or personal judgment of what constitutes efficiency and economy.

There are firms that seek to learn facts systematically and to determine from record of their own business just what can be accomplished with their equipment, methods and administration, and where this character of research can be undertaken it is certain enough that it will be productive of positive and practical results. In some instances a firm will investigate the facilities and work of others engaged in the same business and from the data collected establish a system that will be adapted from what appears to be the most productive of results when the conditions are regarded from differing viewpoints. This appears to be the disposition of numerous concerns that have large equipment and which, while regarding economy as absolutely essential, do not feel justified in making a change involving heavy expenditures without positive assurance that the estimated saving can be made.

In Boston a considerable number of coal firms have begun the use of motor trucks in what may be considered experimental work, and while none has disposed of all its animals and is now dependent upon machines, it may be said that the prevailing opinion is that for short hauls and with the conditions obtaining the animals are the more economical. The service of each firm differs, and though there may be practically the same delivery area it is certain that the expenses of no two are alike. This being so the practical determination of the relative cost can only be ascertained by working both motor and animal equipment. In comparative service it is essential that both types of vehicles be used with the same judgment, for it is apparent that unless the average efficiency is realized with either, at a normal expense and for a sufficient period to learn the fixed charges that should be included, the information will be of little value.

The Staples Coal Company, which has executive offices at 40 Central street and yards in Albany street, in Summer street at South Boston and at East Boston, has had a comparative service for about 18 months, and has during that time used both gasoline and elec-

Delivering a Five-Ton Load of Anthracite Coal at the Massachusetts State House, the Crew Making Short Work with a Sidewalk Manhole to the Fuel Bin.



Taking on a Five-Ton Load at the Anthracite Coal Pocket at the Summer Street Yard for an Eldridge Front Drive Electric Cart Used for Short Hauls.

tric machines. Originally the company had about 175 horses divided between the three yards, and after consideration of the utility of motor trucks three five-ton gasoline chassis were purchased, these being a White, a Peerless and a Mack. These were fitted with dumping bodies. While the desire was to learn the possibilities of the machines for all forms of haulage and to thoroughly test them, it was not believed to be economical to work these constantly on short hauls.

By this is meant that the efficiency of horses is assumed, if not definitely known, and the purpose was to ascertain the utility of the trucks by using them on practically the same haulage as the animals. This would demonstrate the economies of the machines with reference to time and labor, and with the record completed with definite cost of both animal and motor haulage, which could be ascertained later on, it was expected to determine facts with exactness. The company has large plants and excellent facilities for handling coal. The greater part of the anthracite fuel handled is brought from the barges and vessels by elevators and carried on elevated conveyors to bins or pockets, from which the carts and trucks are loaded by gravity. Much of the bituminous coal, however, is piled beneath the conveyors and this may be loaded with machines or by manual labor, the manner of loading depending somewhat upon the size of the piles and the conditions.

Practically all of the carts and the trucks are fitted with dumping bodies, so that there is the same relative economy with either for loading or unloading, and while it may be possible with such change of facilities as careful judgment would dictate that time could be saved for the trucks (assuming that there could not be similar saving for horses), it will be understood that the working of the combination equipment affords actual knowledge of what may be accomplished by superior speed and somewhat greater capacity.

The Staples Coal Company's distribution is throughout Boston and the suburbs, but from the location of the yards in different sections of the city the haulage from each is minimized as compared with what might be required were there but one yard. The trucks are worked from the South Boston yard and with them are in service horses that are driven an average of 16 miles daily, and haul four tons as a load for a team of two under normal conditions.

The trucks are garaged at the yard and are given the ordinary care and attention that is necessary by the drivers, but when a condition is known that requires specific knowledge and mechanical skill the machines are sent to the service stations of the makers, or are repaired at the garage by mechanics sent from the service stations when special facilities are not required in the work. Were the number of machines sufficient to justify it would no doubt be more profitable and economical to maintain a regular garage organization with a repair shop and machine tool equipment. But against this must be placed the expert knowledge and the resources of the service stations. But this does not appear in the bald financial statement.

In July of last year the company took delivery of

Eldridge Five-Ton Front Drive Cart Equipped with Dumping Body Loaded with Soft Coal—This Machine Is Used Generally for Work Ordinarily Done with Horses.

the first of three Eldridge front-drive electric carts, these being of five tons capacity each. These machines are built with a forebody fitted with wheels made under the Couple-Gear patent, the motive power being two three horsepower motors carried on the ends of the axle stubs, driven by energy from a battery located under the seat. The construction is heavy throughout and is intended to endure a long period under all conditions of use. There is practically no mechanism save what is contained in the wheels, and the motors are mounted horizontally on the axles so that the pinions on the ends of the armature shafts engage with racks in the edges of the heavy steel discs that carry the wheel rims and tires. The inner disc has a large bearing on the axle and supports the weight of the forebody and a part of the load.

The wheel stubs of the front axles are mounted in yokes on pivots and the cart is steered by the front wheels, the shaft of the steering gear being vertical, a pinion at the lower end meshing with a sector, and the upper end being surmounted by the hand wheel. The battery is located under the seat and the controller case is directly in front of it, there being a small removable lever on top of the housing. The forebody has spring suspension, but the cart construction, that is rigidly coupled to it, is carried on a dead axle, exactly as all carts, with large wheels shod with steel tires. These machines have been used by a number of coal companies in Boston and vicinity for haulage within a limited radius.

The maker claims for these machines that they can be driven from 25 to 30 miles on a single battery charge and on level, hard roads, and that they are most economical when worked on hauls not exceeding five miles. Although they have a speed of six miles an hour maximum, they are seldom driven faster than five miles. The expense estimated by the maker is $8.16 a day when kept at the garage of the owner, and $9.53 when stored at a public service station. This expense includes a renewal of a battery annually and one new set of rubber tires each year, and depreciation of 10 per cent. Solid rubber shoes of the dual type are used on the traction wheels, and it is maintained that these will give the estimated daily mileage for 300 working days a year. Where the work is such that greater capacity is desired this can be obtained by exchange of batteries, the removal and replacement requiring but little time or labor with satisfactory equipment.

The keeping of the gasoline machines in the company's garage is an economy as compared with the garaging of the three electric carts at the Atlantic Avenue Electric Garage, because of the somewhat greater cost this entails, and the use of energy going to and returning from the yard at the conclusion of each day's work. It is a fair assumption that this adds not less than three miles to the total required for work, which will mean at least 900 miles a year that is absolutely unproductive. This lost mileage is usually made with the carts unloaded, but it is a considerable item under any circumstances. As two of the principal costs of operation are for tires and batteries renewed, it will be seen that unless this matter of garaging is carefully considered its importance in cost determination is not fully realized.

The two electric carts last delivered were placed in service in September, and the three have been used practically six months. Though occasionally utilized for longer hauls the machines have been worked in closer competition with the horses, and basing conclusions on the information already possessed it is maintained that animals have apparently proven the more economical for hauls up to 2.5 miles, where the traffic is congested and the speed of the motor carts is practically limited by the movements of the other vehicles. The truck and motor cart delivery service must encounter this traffic and it is governed by the traffic regulations, which are decidedly exacting during the business hours of the day.

The summary of the results accomplished by the machines, both trucks and carts, during a period of six months is decidedly interesting. The loads for these vehicles are five tons, and no divided orders are sent out in them. Both anthracite and soft coal are hauled, and often it is possible to unload by dumping. The mileage of the electrics for the time stated was 3130, and for the gasoline trucks 13,729, but the average haul of the electrics has been 3.94 miles to a trip and of the trucks 8.24 miles. According to the statistics kept by the company the electrics will give approximately 20 miles on a single battery charge, which is about 6000 miles for the year, and is about 25 per cent. more than could be expected of a pair of horses, to say nothing of the 25 per cent. greater load carried.

Considering the greatest efficiency of the horse up to 2.5 miles a haul, it will be seen that the electric carts have made an average of 63.44 per cent. more than that standard, although the average mileage of the animals is not stated. The gasoline trucks have had an average haul of 8.24 miles, which is more than half the stated mileage for a day for horses, and should represent a decided economy when contrasted with the economic haulage distance for the horse as established by the company. The truck is rated as the equal of six horses, which means one five-ton machine can do work that would require three animal carts of four tons capacity, at least for the character of haulage for which this company uses its gasoline vehicles.

Work of the six machines for the six months is recorded as 1667 separate jobs, and with a total of 16,589 miles this shows the average mileage a trip to be 10.11 plus, and an average haul of 5.06 miles, although these figures do not agree with the individual averages of the two types of machines. The statement is made that the motor trucks and carts take the place of 35 horses, the animals in service being reduced in number to 140, and this has also caused the withdrawal of approximately 17 carts, for these cannot now be used, though it is possible that they might be practically utilized as trailers. The company has not as yet considered tractors or trailers, and one reason that would probably militate against such method of haulage is the heavy and slow traffic and the necessity of having

sufficient room for handling them. From the viewpoint of the coal dealer the tractor is not an attractive proposition, although there is no doubt of the economy of the equipment were the conditions such that it could be used.

Within a short time the company ordered the second White truck and when this is delivered it will use the two White and the Peerless machines. The intention is to continue the equipment now used until a sufficient period has elapsed to determine the exact data required, and then to make such changes as will appear advisable to be most economical with reference to ratio of type of vehicle. The gasoline trucks have been worked practically through two winters and the electric through one, and with the information deduced from the records kept it is not improbable that another year's experience will bring about considerable changes. There is no question, however, that the practical use of the equipment will be a decided benefit, for the knowledge obtaining from experience will mean a very full measure of economy.

STUDEBAKER ONE-TON TRUCK.

New Worm-Driven Delivery Wagon That Has Many Novel Features of Design.

The one-ton electric delivery wagon which was shown for the first time at the New York show by the Studebaker Corporation, Detroit, Mich., is noticeable from the fact that it is direct driven by a worm and gear wheel, but it is a very interesting design from many other points of view. The designer has departed from conventional practise and has mounted the motor in a very novel manner. He has suspended the battery so that it is claimed to be very free from the influence of road shock.

The motor is installed in a cradle formed from the two radius rod members, which extend from the ends of the housing of the full floating rear axle and are secured to a centre member that is movable on a transverse pivot carried in a frame cross member. While the drive is through the radius rods the relation of the motor, its shaft and the rear axle is never changed. The Wagner motor is so mounted that by removing two bolts it may be dropped, and by removing four more bolts the armature can be taken from the housing. The rear axle has a pressed steel housing and the shafts are fitted with Timken bearings. The worm gear is forged integral with the drive shaft and the shaft is carried on annular ball bearings and is fitted with two thrust ball bearings. The axle shafts are constructed so that they clutch the inner and outer flanges of the wheel hubs. The frame is a pressed steel channel section five inches width and two inches depth. This is mounted on semi-elliptic springs 42 by 2.5 inches forward and 50 by three inches rear, and the forward ends of the rear springs are mounted on the battery cradle, which is claimed to bring half the weight of the battery on the springs. The front axle is a steel drop forged I section. The battery cradle is mounted under the frame and the compartment is housed with agasote, which is moisture proof and affords a very even temperature. The floor is hard wood and drained. The battery crates are held by a bar that is secured by an eccentric locking device. The cradle is designed to use different types, sizes and makes of battery without change. The power wiring is protected by a pressed steel housing. The controller is operated by a lever centrally located in a U shaped slot, the base of the U being neutral and the four forward speeds and the three reverse being obtained by forward movements of the lever in the left and right sides of the slot respectively. The service brake is operated by a pedal and the emergency brake by a lever beside the control lever. As the emergency brake lever is operated it automatically throws the control lever to neutral. The switch key cannot be applied with the control lever in either the forward or reverse slots. The brakes are external contracting on drums on the rear wheels. The steering gear is a worm and gear type. The charging receptacle is placed in a compartment in the base of the dash, reached from the front, and there is a switch that automatically disconnects the charging circuit when the maximum of charge has been reached, and this maximum charge can be varied as desired.

SAURERS FOR RUSSIAN ARMY.

Recent Purchase Includes Travelling Repair Shop for Work on Aeroplanes.

The International Motor Company, New York City, announces that the Russian government has purchased a number of Saurer trucks, made by that company. Included in the number is an interesting type of army truck known as the aeroplane repair vehicle. This is a standard five-ton Saurer chassis, equipped with 37 horsepower motor, chain drive and solid tire equipment. The maximum speed is 15 miles an hour.

The body platform has sufficient space for a machine shop equipment consisting of a five-kilowatt dynamo and engine lathe driven by a small electric motor, shaper, band saw, drill press, portable anvil with block, portable forge, carpenter's working bench with wooden and steel vises, an acetylene welding apparatus with oxygen tank, emery grind wheel, hand drills, etc. Along parallel lines are closets for tools, etc. The total weight of this portable machine shop is 15,000 pounds.

H. J. Koehler, president of the H. J. Koehler S. G. Company, New York City, announces that he has just completed a sale of a battery of 10 Koehler commercial cars to the Public Service Gas Company of Newark, N. J. The machines are to be fitted with special bodies and will be used in different sections of New Jersey for general hauling and emergency work. It is stated that the company has had a number of electric trucks in service and that the Koehler cars are the first of the gasoline type to be installed.

The
MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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THE BOSTON TRUCK SHOW.

The business possibilities of the power wagon show at Boston are extremely promising, and with the unusual interest in motor trucks and wagons manifested by business men there is reason to believe that the exposition will attract many buyers. It can be accepted as a fact that there will be few attracted to the show from curiosity, and the exhibitors who do not make provision for the presence of the best of their selling forces will make serious error. A year ago, following the extreme rush of the pleasure car show, some of those having exhibits were content to leave their stands with but one person during the day, and in several instances failed to have men in charge who were capable of doing full justice to the machines. There was generally a sufficient number in attendance in the evening, but the opportunities of the day, when many were present from out of the city, were often lost.

LIMITING VEHICLE WEIGHT.

In Massachusetts a bill is pending before the legislature that limits the weight of motor vehicles and their loads to 12 tons. It is proposed in other states to enact similar restrictions. The Massachusetts bill, which is a compromise of those interested in motor trucks and the highway commission, which indorsed the measure, will possibly be adopted. If the highway commission will consult its own records it will be found that former Chairman W. H. McClintock was very emphatic in the statement that unless a vehicle was moving 15 miles an hour it did not damage the highways. If the bill is wholly with reference to bridges, it will be found that the majority of the trolley cars used on suburban routes weigh from 11 to 14 tons unloaded, and with reasonable freights several tons additional, and if the bridges are not safe there should at least be consideration of the people who ride in these cars.

Each year the Massachusetts highway commission has proposed legislation that has seemingly been directed toward limiting the possible uses of practical vehicles for highway haulage, and generally with the claim that the roads were wearing under the traffic. The logic of such a declaration seems without foundation from the fact that highway transportation must increase, and as it is greatest on the main and improved thoroughfares and least on those not in good condition, these roads must be worn. As they wear they must be maintained. According to the figures collated by the commission the business wagons are increasing in numbers very rapidly. The towns benefit through such use. If the highway commission were the ally of railroad corporations that would control all haulage it could not direct its influence to a better purpose than it now does.

DRIVING TRUCKS WITHOUT LOADS.

Men of experience know that more actual wear results from driving a motor truck unloaded than when loaded, and this from the fact that the heavy springs have absolutely no resiliency when not under pressure and might just as well be dispensed with so far as their usefulness is concerned. That is to say, that if the construction were without springs there would be no material difference in effect upon the vehicle so long as it were driven unloaded, and in general use this is 50 per cent. of the time at least. It is evident that were the springs to have the same effect when the vehicle is unloaded as when loaded there would be a very large reduction of the wear resultant from excessive vibration, but this is not possible with designs of the present day.

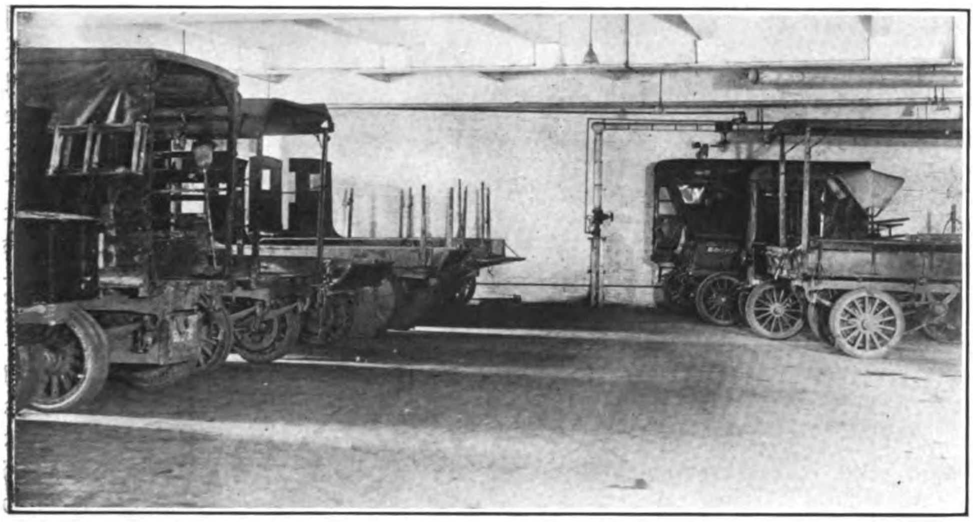
The only remedy then is to minimize the speed when driven without load, for the assumption of practically all drivers is that this period of use is when a machine can be operated to its maximum speed. This may appear to be a paradoxical statement, for it will be maintained by many that it is unwise to drive as rapidly when loaded as unloaded, but the real secret of truck efficiency is not speed, but in keeping it moving. Uniformity of pace and expedition in handling the freights carried are two extremely important factors in economical motor wagon operation, and an average of even six miles an hour for a half-day will give a very satisfactory day's work when measured by mileage.

CENTRAL STATION TRANSPORTATION.

The Motorized Service of the Rochester, N. Y., Railway & Light Company, Includes 61 Wagons, the Largest Number in Proportion to Population in Use in This Country---The Development of Four Years.

By William W. Scott.

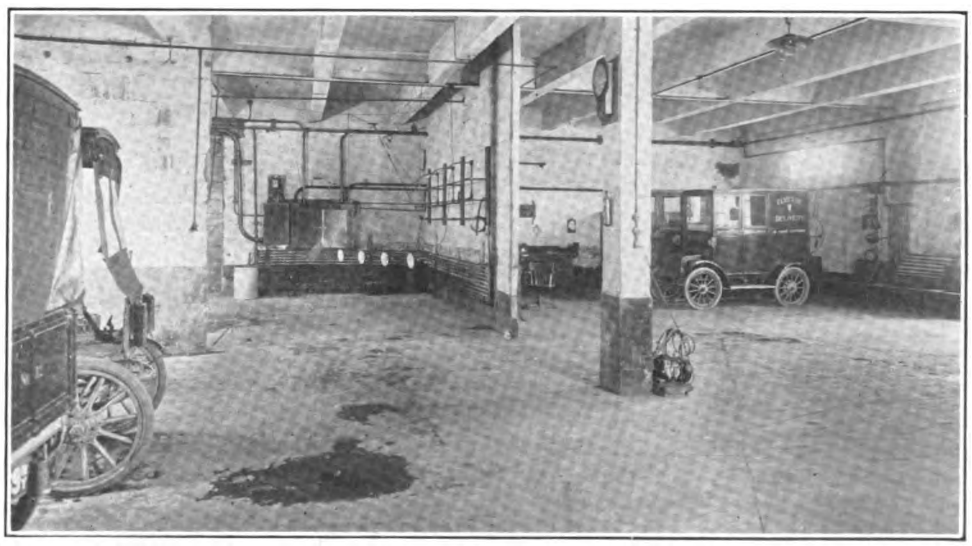
THE practicability of the use of electric vehicle equipment by central stations located in cities of moderate proportions has been established very conclusively by the experience of the Rochester Railway & Light Company, Rochester, N. Y., one of the best known and most progressive public service corporations in New York State. There may be supposition that the practical economy of the motor vehicle can be best realized by central stations in the largest cities, for theoretically in such municipalities the cost of haulage is relatively more than those of lesser size, but this assumption does not have foundation when even casual analysis is made.



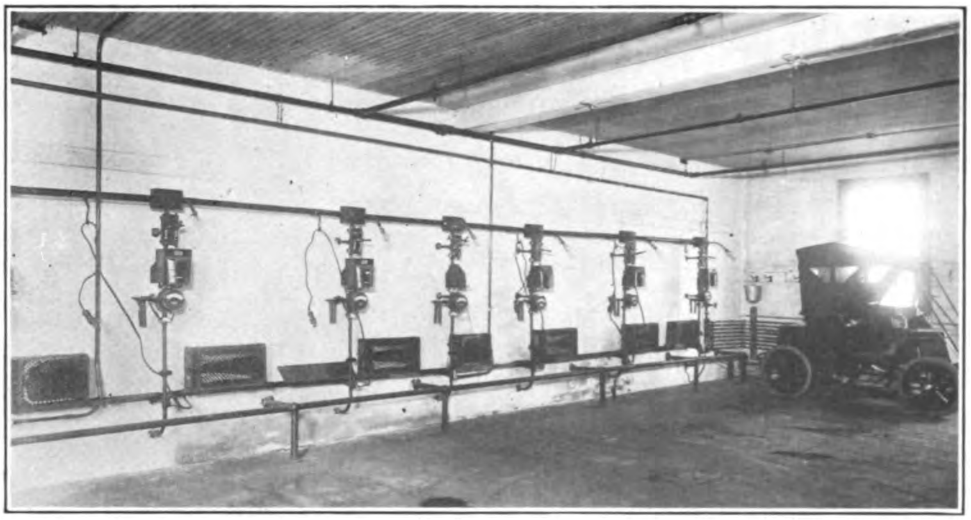
The Main Garage of the Rochester Railway & Light Company, in Which the Truck and Heavy Wagons Are Stored.

To illustrate, the transportation department of the New York Edison Company, the largest corporation of the kind in America, which serves Manhattan Island and the Bronx, is not twice as large as that of Rochester, and while the former company serves a population of perhaps 2,500,000, the residents of the area served by the Rochester company are probably less than 300,000. When one considers the areas in which the two companies operate there is probably little difference, but there is in New York the greatest concentration and in Rochester there is what might be compared with the suburban conditions of New York. Yet there is this difference, which will account for the apparently large number of machines in use in Rochester, and that is that the company generates and distributes gas for illuminating purposes and for fuel, as well as supplies electric current for lighting, heating and power, while in New York the Edison company sells electric energy only.

In other words, the gas department of the Rochester company, which covers the same territory as the electric department, necessarily requires transportation. This division is not subordinated to the other and it is promoted and developed carefully. While it is not possible to state the relative proportions of the two departments, it is obvious that the combination of the two with reference to vehicular service has necessitated the use of a much larger number than might be assumed by those who have no accurate knowledge. Incidentally it may be pointed out that the Rochester company may be paralleled so far as combination service is concerned by hundreds of companies, and the transportation requirements will be found to be analogous. Rochester may be regarded as a large



No. 2 Garage of the Rochester Railway & Light Company, Showing the Washstand Separated from the Main Floor.



No. 3 Garage of the Rochester Railway & Light Company, in Which the Runabouts and the Light Wagons Are Kept.

city in the sense that there are only about 25 cities in the United States that exceed it in population, and it may be maintained that the same experience would hardly be realized in cities of lesser size, but it will be understood that haulage economy will obtain wherever motor vehicles are used judiciously, although it is evident that there will be the greater ratio of saving as the number of machines is increased.

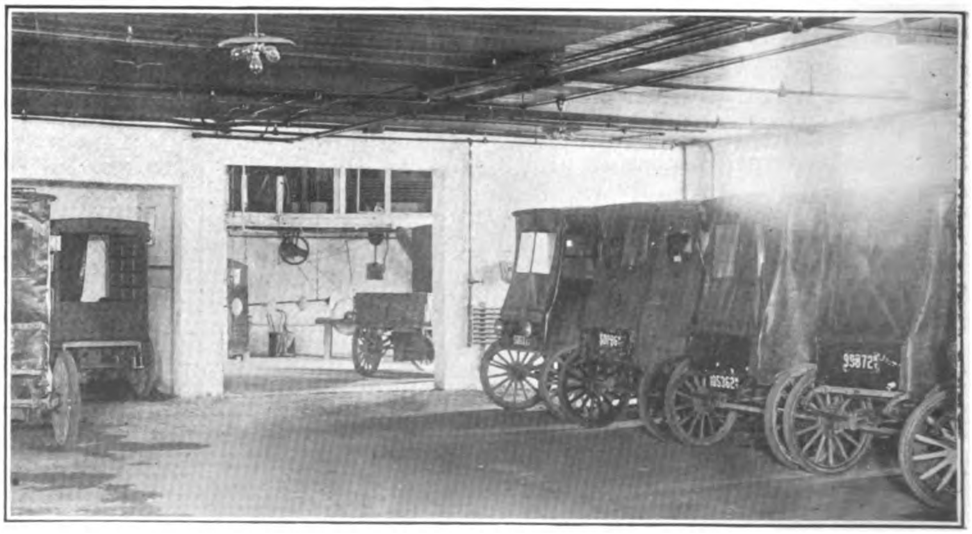
The Rochester Railway & Light Company is progressive and its property will compare favorably with that of any similar concern in the country. All construction is high class and well maintained, its equipment is modern in every respect and expansion is made with regard for future requirements. Four years ago it used 60 horses in its transportation department, and this number has been reduced to six, while the animals dispensed with have been replaced by 52 electric wagons and trucks, and nine pleasure cars, some of them small gasoline machines, are also utilized. The question will naturally arise of wherein is the saving when 54 horses have been disposed of and 52 motor wagons and several cars substituted, especially when it is known that one power wagon is believed to be the equal of at least two horses.

In answer to this it is necessary to point out that besides its animal equipment the company was compelled to hire cartage constantly, this excess service amounting to a considerable amount annually, and during the past four years the extensions of the gas and electric mains have increased the area served approximately 50 per cent. Rochester has for a number of years grown very rapidly, and the suburban and the industrial development has entailed corresponding service from the company. This expansion has largely increased the demands upon the service department, and it is not unreasonable to assume that were horses used exclusively today a much larger number would be necessary than when the first electric was installed. But as the limitations of the stables of the company had been reached, to have continued with horses would have meant the construction of additional buildings and a larger investment, as well as the utilization of land that would be expensive if acquired.

The company has three sources of electric energy, the one being the plants that are on the banks of the Genesee river and are driven by water power, the second being steam plants located practically in the centre of the city, and the third the lines by which the current from power stations on the Niagara river is transmitted about 80 miles and drawn upon as requirements may necessitate.

Contrary to the usual custom of concentration the Rochester power stations are separated and there are about a dozen of them located within a mile circle, each of which serves a certain area of the city, but all are so connected that in the event of need the service may be continued without interruption should it be necessary to continue the operation of any one for a period. The gas producing plants are quite as advantageously located.

The section in which the company gives service may be covered by a circle 15 miles in diameter, in which Briden is the most distant point of consequence, and this is about seven miles from the centre of the city. The total area is about 100 square miles. The topographical conditions are such that transportation expense cannot be regarded as excessive when contrasted with other localities.



No. 4 Garage, Used for Light Wagon Storage, Which Is Connected with the Machine Shop.

Section of the Machine Shop of the Rochester Railway & Light Company, Which Has Abundant Space and Ample Facilities.

needs of the department were realized horses were disposed of and new motor wagons and trucks purchased, so that now there are the 52 electric machines in service, as well as nine electric and gasoline pleasure cars, making a total of 61 used by the company.

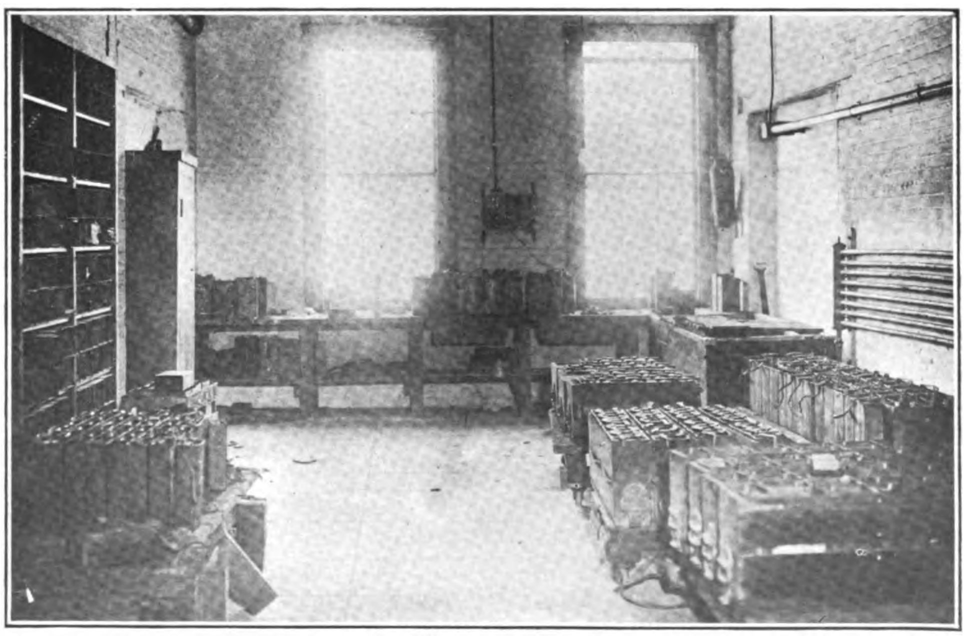
As the animals were sold and the machines were added to the service the stable buildings were remodelled and fitted to serve as garages, which necessitated the removal of partitions and fittings, the laying of cement floors and the installation of such equipment as was necessary. That this work was not done at one time and it was necessary to progressively increase the facilities did not permit of as economic an arrangement of the garage as might have been possible under other conditions, but as the needs were realized the equipment was added. As the buildings are nearly all connected and the different garages are convenient to the other departments, there is no loss of efficiency through the conditions.

As it now is the garage will afford storage for a considerable number of machines in excess of those now cared for, and the repair shop and battery room are of such capacity that they will suffice for any demand that will develop. The fact that the battery room is ample for all probable requirements for several years to come, and the repair shop will house more machines than will ever be withdrawn from service under normal conditions indicates that the buildings were fitted with careful consideration of the possibilities. There are three buildings given over to

While it was logical enough for the company to turn to the electric vehicle from the fact that it produced electric current, and it might be maintained that it would be good business judgment to operate several machines at a considerably higher cost than of horse wagons because of the generally promotive effect of such vehicles in its service, the proposition comprehended a complete translation of the transportation equipment, which could not be made on any other basis than economy.

In the determination of the proposition it was believed the company was in a favorable condition for making a gradual change because one of the stables could be utilized for the initial garage, and then the others could be adapted for general or specific purposes as the need was realized. Had there been one large stable it is probable that the problem might have been more perplexing, but the conditions favored a practical trial of the machines. Accordingly six machines were ordered and these were placed in service in June, 1909. A section of a stable was transformed into a garage and an organization was created for the systematic care and maintenance of the equipment. The company realized that it was necessary to keep the vehicles to a standard of efficiency, and that this could not be done unless there was careful oversight, and that system was imperative in insuring the productiveness of the service.

It is not necessary to go into detail of the experience of the company, but the best evidence of the satisfaction resulting is that today only six horses are used and the motor vehicles have been increased from time to time. As the



Portion of the Battery Room of the Rochester Railway & Light Company's Garage, Which Is Well Fitted for the Purposes Used.

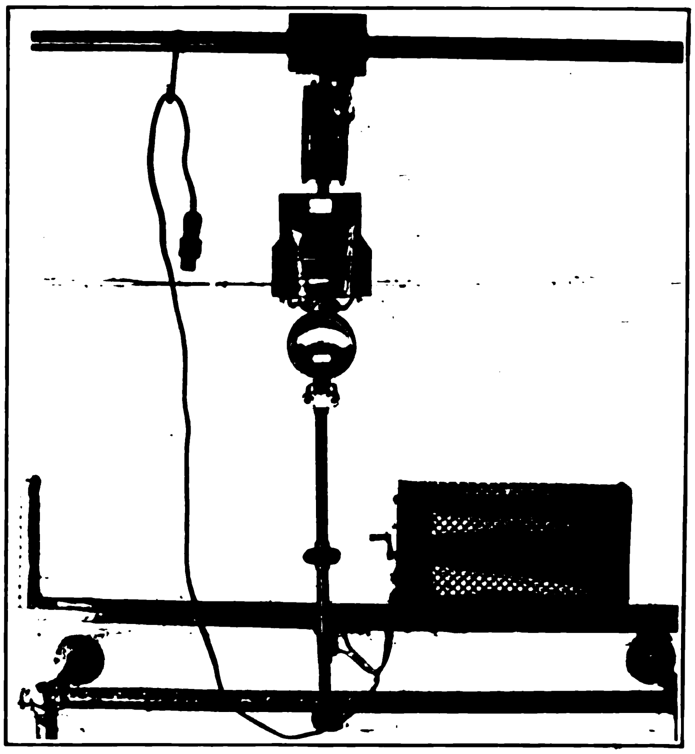
The Fleet of Electric Delivery Wagons and Trucks in Service of the Rochester Railway & Light Company.

the storage of wagons and trucks, and connected with one of these is a washroom where three vehicles can be handled at one time. In one of the garages all the pleasure cars are kept together, and the service wagons are divided according to capacity.

The blacksmith shop is a good sized section that is fitted with every tool that might be needed, and the machine shop is in a comparatively large building that has a fine machine tool equipment, including a lathe, drill press, shaper, grinder, power hack saw and a complete outfit of hand tools. There are pits in the concrete floor to facilitate work under the wagons, and ample benches and good light. The battery room is well arranged to convenience the work, and the facilities are of the best. The lighting is exceptionally good, even in the washroom, there being a variable battery of lamps that may be placed at any desired height. The buildings are well heated and the vehicles are protected against low temperatures, while the ventilation is very good.

One of the features of the garage is the charging equipment, which is installed in the three buildings in which the wagons are stored. The gravity charging is used and instead of the multiple charging panels there is a single station for each machine placed against the wall directly under the main conduit. This station consists of a tablet carrying a pilot light and a knife switch, and below this is a standard that supports a wattmeter and an ammeter, and from this there are leads to the rheostat carried on a bracket at one side of the standard, and the lead that carries the charging plug. Because of the method of charging there is no inconvenience from the use of the individual stations, and there are advantages in that minimum space is required, the cost is comparatively small, and the system can be extended as desired by the addition of such stations as are required. At the base of each station is a small iron pipe rail that protects the instruments and the rheostat and insures against damage or injury from contact.

The description given of the garage is desirable from the fact that the condition met with by the company was unusual, and yet a very satisfactory service has been made possible by the utilization of the old stable buildings. In the transportation department of the company the work of both the electric and gas divisions are handled, this service being under the direction of Frank Hellen, superintendent of gas distribution, and the supervision of the garage is by Mr. Hellen, who is assisted by Thomas W. Nash, foreman of the department. The department records so far as they relate to service are all kept at the division office, and these also show the cost of operation, maintenance and care, but the accounting is by the general office staff, for to the figures compiled must be added the fixed charges, which are not kept separately. The service and garage records are very complete and the forms have been developed from experience, so that they may be said to cover practically every condition that may arise and every probable requirement. But with their completeness the records are comparatively simple, and they are generally of such a character that they may be continued for a considerable period with very little clerical work.



One of the Individual Stations Used for Gravity Charging in the Garage of the Rochester Railway & Light Company.

Rochester, N. Y., the Largest Used by Any Central Station in America Serving a Similar Area and Population.

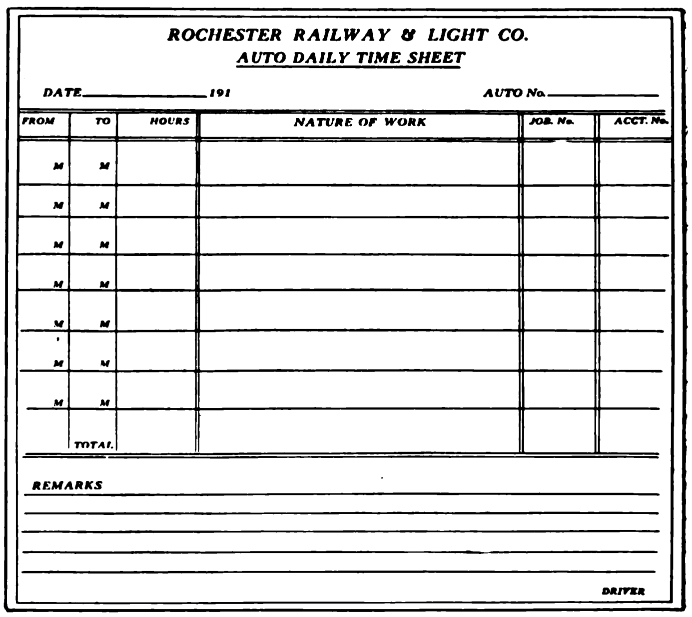
The electric vehicles of the transportation department are generally light, and 80 per cent. of them are of one ton or less capacity. The service is generally what can be given by machines of small capacity, that may move with reasonable speed and be economical of operation. The equipment of the company is as follows:

Capacity, Pounds	Number
700	9
750	1
1,000	24
2,000	9
4,000	4
7,000	2
10,000	3
Total	52

Of these two 700-pound wagons were made by the Baker Electric Vehicle Company, one 750-pound wagon was built by the Walker Vehicle Company, one 4000-pound wagon was produced by the Studebaker Corporation and the other 48 are General Vehicle machines. Brief examination of the sizes of the wagons will show that the company has what might be termed a light vehicle equipment, as it is not necessary to haul much of the supplies and materials used in the power stations. The work is practically all confined to construction and serving customers.

A better idea may be gained by showing the work the different types of wagons are used for. For instance, the 700 and 750-pound machines are used by the electric motor department for carrying out meters that are installed in residences and plants of different kinds, and similar machines are utilized for the distribution of new incandescent lamps and the collection of bulbs wherever these may be needed. The 1000-pound wagons are used by the electric department for taking out and locating arc lamps, for carrying material and tools for use in the line department, and for carrying meters for the gas department. The 2000 and 4000-pound wagons are used for the distribution of stoves and fittings for the gas department, one 7000-pound truck is utilized for pulling cable for the underground construction gang, and the others are worked for general purposes, there being no regular assignment for these machines. One of the 7000-pound trucks is fitted with a winch, and one of the 10,000-pound machines has similar equipment. Where very heavy work is required one of the 7000-pound trucks is used as a tractor and it hauls a body carried on two wheels that is designed to carry eight tons. This tractor has proven to be exceedingly useful and has been found to be unusually economical. The truck can haul the load under all of the conditions that have as yet been met. The trailer or body is so constructed that it may be quickly attached to the truck and in a comparatively short time the outfit may be made ready for work.

One wagon is fitted with what is known as a "house pump," and is used for pumping accumulations of water from the gas pipe, a work that is done very frequently, and another is utilized as an emergency wagon, it having such equipment as would be ordinarily useful in making temporary repair or restoration of wagons that have for the time being become inefficient through accident. Under normal conditions there is a regular assignment for each wagon and it is continued in such service unless equipped for special work. This does not apply to the heavier trucks that are used for general haulage, which are assigned from day to day. As might be assumed the mileage that is



ROCHESTER RAILWAY & LIGHT CO.

AUTO DAILY TIME SHEET

DATE ______ 191 AUTO No. ______

FROM	TO	HOURS	NATURE OF WORK	JOB. No.	ACCT. No.
M	M				
M	M				
M	M				
M	M				
M	M				
M	M				
M	M				
	TOTAL				

REMARKS

DRIVER

Daily Vehicle Time Sheet, 5.5 Inches Length and Seven Inches Width, Printed in Black on Pink, and Padded.

MATERIAL

NAME	DATE	HOURS	RATE	AM'T

TOTAL

DATE 191 SIGNED

FOREMAN

Reverse of Inspector's Report, Printed in Black on White.

traversed by the wagons varies considerably. Taking the month of September, 1912, as an example, three of the machines were not in use, but a record of 40 wagons showed that they were in service a total of 1084 days, and that during the month the aggregate mileage was 24,075, an average of 22 miles daily. The smallest average mileage a day for the month was 12, while the largest was 41, and these extremes were the same size so far as vehicle capacity was concerned.

Considering the mileage further it may be said that the average for the five-ton trucks will approximate 30 daily, while the lamp wagons are driven from 35 to 38 under ordinary conditions. The average of all the machines, however, is not far from 25 miles. The number of horses that would be used to do the work assigned to each wagon is difficult to estimate, but all of them will do the work of two on the basis of the daily average mileage, and some the work of three. There is, however, the elasticity that is not found with animals, and in the event of necessity the wagons can be used all of the time aside from the period required for charging, and by the exchange of batteries some of them may be in service almost constantly.

When the company had tried out the first six machines ordered and had found them in every way practical and economical the possibilities through promoting their use received serious attention, for the wagons caused a great deal of interest among the business men. The company's officers regarded the electrics with such favor that an agency contract was entered into with the General Vehicle Company and for a short time a selling campaign was conducted with moderate success, but as the promise for this business was very large, and the opportunities appeared to justify the establishment of a separate enterprise, the Empire State General Vehicle Company was organized. In this concern some of the principal stockholders of the Rochester Railway & Light Company have an interest. With this company it was possible to transact a general motor vehicle business and to exploit every line that justified attention. That is, the formation of the company made it possible to give attention to selling all makes of machines, to sell accessories and supplies, and to afford a general garage service. Until the company could be located its machines were kept at the garage of the Rochester Railway & Light Company, and its office was at the garage, but after the company was established its existence was entirely separate and apart.

There is no doubt whatever that the two-fold interest of the officers of the Rochester Railway & Light Company in electric vehicles impelled careful study of the service possible through their use, and this resulted in the application of practical methods and systematic attention and care, and, consequently, the expansion of the equipment and the garage was with reference to the possible needs of the future quite as much as to the requirements of the present.

The system of the company is especially interesting. Records minimizing clerical work and containing every desirable fact are noted. To understand these data fully it may be well to follow a vehicle through the garage from the time it is purchased, assuming it receives the regular care that is necessary as a result of service. After delivery is accepted the machine is given a number that is continued without change and by which it may be identified. These numbers are without reference to capacity and the ve-

6-09

R. R. & LT. CO.
AUTO No.

L—LOOSE T—TIGHT DY—DRY
A—ADJUST R—REPLACE DT—DIRT

INSPECTOR'S REPORT DATE 191

Controller	Fingers	Contacts	Connect'n	Brakes	Adjustm't	Toggles	Pins
	C.O.S.W.	Snap Sw.	Vaseline		Drums	Lining	
Steering Gear	Oil	Sector	Pin	Motor	No.	Packed	Brushes
	Clamp	Adjustm't			Com.	Rad. Rd.	Line Up
Springs	Oil	Links	Clips	Chains	Adjustm't	Oil	Clean
	Leaves	Hangers	Bolts		Morse	Roller	
				Sprocket	Pinion	Gears	
Wheels	Packed	Adjustm't	Spokes				
	Condition			Counter Shaft	Adjustm't	Packed	
Axles	Front	Rear.					
Tires	New	Patch		Battery	No.	Make	Size
					Cleaned	Miles	
Wiring	Bell	Lamps	Plug	Connect'n	Jar Cover	Rub Cor.	

REMARKS

DATE 191 SIGNED

Inspector's Report, Six Inches Length and Four Inches Width, the Initials of the Company, the Wagon and the Group Designations Printed in Red on White, the Items in Black, on Heavy Card.

E-106 ROCHESTER RAILWAY & LIGHT CO.
GARAGE DAILY TIME TICKET DATE 191

EMPLOYEE NO.

CAR NO.	ACCT. NO.	NATURE OF WORK	HOURS	RATE	AMOUNT
	1	Battery operation and renewal (general)			
	1	Battery operation and renewals			
	1	Ditto			
	1	"			
	1	"			
	1	"			
	1	"			
	2	Repairs of mechanical parts—chassis—Repairs and painting Body			
	2	Ditto			
	2	"			
	2	"			
	2	"			
	2	"			
	2	"			
	3	Tire Expense (General)			
	4	Cleaning—care—charging and misc.			
	5	Office Salaries			
	6	Repairs to Garage and Fixtures			
		Total			

I hereby certify above work was performed and account and car numbers are correct.

Foreman

Time Ticket, Six Inches Length and Width, Printed in Black on White and Padded.

hicles are not grouped as to size. This number is entered on a filing card that is also numbered and dated, and the heading is filled with the name of the manufacturer, from whom purchase was made, the date of the order, the style or type, the capacity by pounds, the form of body, the wheel diameter, the tire sizes, the make of battery, the number of battery cells, the battery ampere-hour capacity and the type or maker's designation. The wheels are numbered with reference to position, the right front being No. 1, the right rear No. 2, the left rear No. 3 and the left front No. 4, but each wheel is given a serial number that is continued through the service of the wheel, this being used to identify it should it be changed on a vehicle, or shifted from the one machine to another. This wheel serial number is stamped on a brass plate that is secured to the felloe of the wheel. In the card record the serial number is noted on each wheel, as will be seen from an examination of the card form. The maker's serial number of the tire on each wheel is entered on the card, but each tire is further identified by the tire serial number of the company, and the latter is used through the records, the former being merely useful when dealing with the manufacturer, should there be occasion to do so. The machine is weighed and it is then ready for charging, it being assumed that an inspection has established it in perfect operative condition.

This card is arranged for 32 entries, one for each day of the month and a total, and on it are entered each service data, showing the date use was begun and any change of battery, wheel or tire; the material cost, showing the part and the cost; the labor expense, showing the cost of work on battery, electrical element, chassis mechanism and miscellaneous; the time the machine was out of the garage, the number of miles driven, the current used in kilowatt-hours and ampere-hours and the name of the driver. The card is renewed the first of each month and this record is of the machine as it is in service, but by reference to the cards it is possible to learn of any essential fact that may be desired.

For instance, the cost of labor and material is accounted for, any change of battery, tires or wheels are shown, and the hours and miles of service and the current used, but of course this does not indicate the wages of the driver, the proportion of the fixed charges that shall be applied, and the value of the work is not noted other than in number of miles driven.

From this series of cards is each month compiled a sheet under the heading of "Cost of Auto Maintenance." This is in effect a summary made up largely from the totals shown by the cards, and it is a very interesting statement, for it permits comparison of the service and operating cost aside from the fixed charges. In making up this sheet the vehicles are grouped by capacity without reference to number, for the purpose of convenience "style" being the designation of size. The first column shows the number of days in service, the total number of miles driven, the average daily mileage, the current used in kilowatt-hours and the average kilowatt-hours a mile driven, the total cost of labor, the total cost of material, the combined totals of the cost of labor and materials, the average daily cost of labor and materials, the average cost of labor and materials a mile driven, the average cost of operating the vehicles, and the average number of days each wagon was in use.

The combination of the usual index card and the working record of the machine simplifies the clerical work and with these cards the cost summary is made up each month in the general offices. The removal of the cards does not in any way delay the continuity of the record, and the preservation of the cards is provided for by filing those of each vehicle separately.

When a wagon has been placed in service a driver is assigned to it, and the work may be of a regular character or it may be general haulage and delivery, but the record is kept on a "daily time sheet" that is identified by the number of the vehicle. Usually a sin-

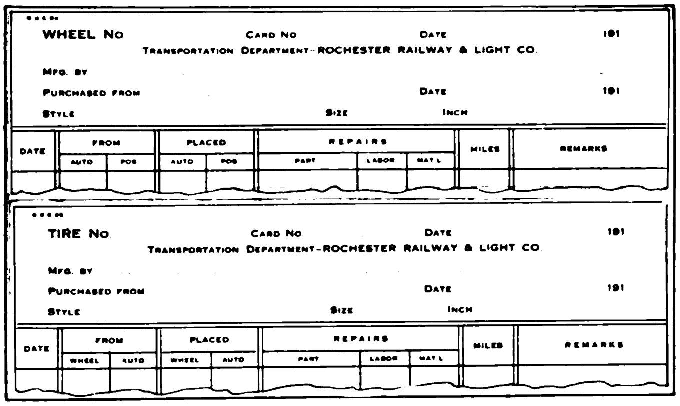
AUTO NO. CARD NO. DATE 191
TRANSPORTATION DEPARTMENT—ROCHESTER RAILWAY & LIGHT CO.
MFG. BY
PURCHASED FROM DATE 191
STYLE LB. BODY.
WHEELS INCH. NOS. R. F. L. F. R. R. L. R.
TIRES INCH. NOS. R. F. L. F. R. R. L. R.
BATTERY. CELLS. A. H. CAP. TYPE. NO.

DATE PLACED	BATT. NO.	WHEEL NO.	TIRE NO.	MATERIAL COST		LABOR COST				TIME OUT	MILES	K.W.H.	AMP. HRS.	DRIVER
				PART	COST	BATT.	ELEC.	MECH.	MISCEL.					

BATTERY NO. CARD NO. DATE 191
TRANSPORTATION DEPARTMENT—ROCHESTER RAILWAY & LIGHT CO.
MFG. BY
PURCHASED FROM DATE 191
TYPE NO. CELLS CAPACITY

DATE	PLACED		REPAIRS			MILES	K.W.H.	AMP. HRS.	NO. CHARGES	REMARKS
	FROM	WHERE	PART	LABOR	MAT'L					

Above the Monthly Wagon Record, Nine Inches Length and Seven Inches Width, Printed in Black on White Card, Ruled for 32 Entries; Below, Battery Record, Same Length, Width and Color, Ruled for 34 Entries.


WHEEL No CARD No DATE 191
TRANSPORTATION DEPARTMENT—ROCHESTER RAILWAY & LIGHT CO.
MFG. BY
PURCHASED FROM DATE 191
STYLE SIZE INCH

DATE	FROM		PLACED		REPAIRS			MILES	REMARKS
	AUTO	POS	AUTO	POS	PART	LABOR	MAT'L		

TIRE No CARD No DATE 191
TRANSPORTATION DEPARTMENT—ROCHESTER RAILWAY & LIGHT CO.
MFG. BY
PURCHASED FROM DATE 191
STYLE SIZE INCH

DATE	FROM		PLACED		REPAIRS			MILES	REMARKS
	WHEEL	AUTO	WHEEL	AUTO	PART	LABOR	MAT'L		

Above, the Wheel Record; Below, the Tire Record; Nine Inches Length and Seven Inches Width, Printed in Black on White Card, Ruled for 36 Entries.

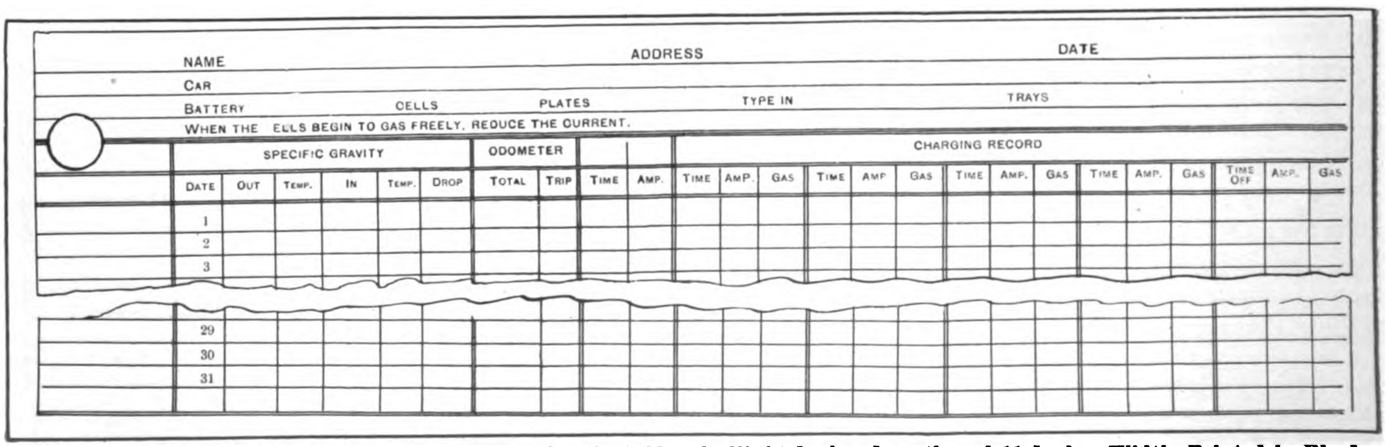
gle blank will suffice for a day's work, there being seven entries possible on a sheet, these showing the date and the work in periods of time from the start to completion and the time so occupied; the nature of the work, the number of the job and the number of the account to which the work is charged. This is supplemented by remarks, if necessary, and the signature of the driver. These sheets are deposited in a box in the garage office and each morning are sent to the general office. It will be understood that the cost of haulage with reference to any work is charged against the job and this is included in the charge to the customer when the bill is made out and sent to the individual.

The machines are used generally through the day and when they are returned to the garage the drivers make report of any condition that has developed that should receive attention. Under ordinary circumstances need of adjustment or repair will be manifested from operation. The reports are received by the foreman. As the machines are brought into the garage they are washed as rapidly as this can be done and after being placed on charge are oiled and greased. In the washing, cleaning and oiling the wagons are so closely examined that any untoward condition may be discovered, and if such discovery should be made report is made to the garage foreman. Unless the condition reported is inconsequential the foreman orders an inspection of the wagon, and this necessitates an examination of the machine in detail and a statement of the work found necessary upon it. This report is turned over to the night foreman and if the work can be completed before the wagon is again needed for service it is done.

This inspection card necessitates a systematic examination of the controller, the steering gear, springs, wheels, axles, tires, wiring, brakes, motor, chains, sprockets, countershaft, battery and connections, and may include all of 54 different items and such other condition as may be found. Possibly suggestions are made in addition to the items of the report. Taking this report, the foreman notes the material needed on the reverse of the card, which order may be amplified as the work progresses, and later the name of the mechanic, the date, the number of hours of labor, the rate of wage an hour and the total charge for labor are entered. The summaries of the items are certified by the foreman. This card is a full record of the condition of the machine, the work necessary, the material required and the labor performed, as well as the cost of the labor. From these cards and the requisitions on the stock room of parts, supplies, accessories, etc., the monthly records are filled.

While this provides for the repairs that are definite in character and which will take specific material and labor, provision is made for recording the time of the workmen when engaged on work that may be regarded as general attention or is not provided for by the inspection cards. This is noted on the "daily time ticket" by the workmen, and the work may be charged to any one of six accounts specified. The number of the vehicle, the number of hours, the rate of hourly wage and the total charge is credited to battery operation and renewals, either general or specific; to repairs of mechanical parts of the chassis and to body repairs and painting; to general tire expense; to cleaning, care, charging and miscellaneous; to office expense or to repairs to garage and fixtures, and these credits are certified to by the foreman as correct with reference to the work, the account and the number of the machine. These items may be classified under the head of general operation expenses.

When a tire is received from the stockroom a file index card is filled and on this is entered the company's serial number, the number of the card, the date, the name of the manufacturer, from whom the purchase was made, the date of purchase, the style and the size.


NAME ADDRESS DATE
CAR
BATTERY CELLS PLATES TYPE IN TRAYS
WHEN THE CELLS BEGIN TO GAS FREELY, REDUCE THE CURRENT.

SPECIFIC GRAVITY						ODOMETER				CHARGING RECORD														
DATE	OUT	TEMP.	IN	TEMP.	DROP	TOTAL	TRIP	TIME	AMP.	TIME	AMP.	GAS	TIME	AMP.	GAS	TIME	AMP.	GAS	TIME	AMP.	GAS	TIME OFF	AMP.	GAS
1																								
2																								
3																								
29																								
30																								
31																								

Battery Charging Record, Requiring Daily Entry for Each Month, Eight Inches Length and 11 Inches Width, Printed in Black on White, with Red Vertical and Blue Horizontal Ruling, Perforated for Loose Leaf Binding.

USE THIS SHEET FOR INDIVIDUAL CELL READINGS DURING OVERCHARGE AND FOR INITIAL CHARGE READINGS

DATE																		
TIME																		
TEMP																		
AMPERES																		
BY																		
CELL No.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.	Sp. Gr.
1																		
2																		
3																		
4																		
5																		
38																		
39																		
40																		
41																		
42																		
43																		
44																		

Reverse of Battery Charging Record, Arranged for Individual Tests of Cells During Overcharge.

If the tire was received with a machine this record is made and when a change is from one wheel to another or from one wagon to another, the entry shows the number of the wheel and the number of the wagon from which it was removed and the number of the wheel and the number of the machine on which it is placed. When a repair is made an entry shows the nature of the work, the cost of labor and material, and the mileage is recorded with reference to each vehicle. If occasion requires a statement is made relative to condition, endurance, etc.

With each vehicle wheel a card record is made for an index that shows the number, the card number, the date, the name of the manufacturer, from whom purchase was made, the date of purchase, the style and size. This record is in form identical with that made for the tire so far as changing from the one vehicle to another is concerned, with the cost of the repair with reference to parts used and the labor and material. The mileage of the wheel is also kept.

The record of the battery received with each machine or purchased separately is also kept on an index card, this showing the number of the battery, the number of the card, the date when the card was filled, the name of the manufacturer, from whom purchase was made, the date of purchase, the type, number of cells and capacity. In the event of change the date of the change and the numbers of the wagons from which it was taken and installed are entered, and under the heading of repairs is noted the part used for repairing, the cost of labor and the material. The miles used, the total kilowatt-hours, the number of ampere-hours and the number of charges given are noted, so that the service of each battery may be traced, no matter how many vehicles it has been used with, and the condition is also recorded. This card is continued during the period of usefulness of the battery.

The charging record shows the number of the vehicle, the date, the make of the battery, the number of cells, the number of plates, the type, the number of trays of cells, and one form suffices for a month. The entries show the specific gravity of the battery as shown by the pilot cell when leaving the garage, and the temperature of the battery; the specific gravity and temperature on the return to the garage; the drop in specific gravity during the use of the battery; the trip and the total readings of the odometer; the time of the trip; and the record of charging shows when it was begun, the charging amperage, the time when the amperage was reduced and the condition with reference to gassing. Provision is made for three separate periods of charging. Once in two weeks, or as often as may be believed to be necessary, the battery is given an overcharge, and then each cell is tested as to specific gravity and is equalized and brought to its highest state of efficiency. In the overcharging it is necessary to test each cell no less than 18 times, the time, the temperature and amperage being noted for each test. This sheet is signed by the person supervising the charging.

The gravity system of charging is employed exclusively, and it is maintained that this affords a more accurate knowledge of the battery and each individual cell than would be possible by charging by voltage, and that it is possible to better balance the cells and have a more efficient battery. The record of each bat-

COST OF AUTO MAINTENANCE FOR MONTH OF SEPTEMBER, 1912.

Auto No.	Style	Days in Use	Total Miles	Avg. Miles per Day	K. W. H. Used	K. W. H. Used per Mile	Total Cost Labor	Total Cost Material	Total Cost Labor & Material	Avg. Cost Labor and Material per Day	Avg. Cost Labor and Material per Mi.	Avg. Cost per Auto	Avg. No. Days in Use per Auto

Cost of Vehicle Maintenance Sheet, Typewritten on Sheet 12 Inches Square, and Having an Entry for Each Wagon and a Footing of the Different Columns.

tery is kept separate and it is possible to gain more specific information from it than from the form that is customarily used with voltage charging.

The garage organization includes 12 men, that on duty days consisting of the foreman, a mechanic, a machinist, a batteryman and two helpers, and there are on duty nights a foreman, a batteryman, a mechanic, a man who waters batteries and assists in the repairing of electric vehicles, and two helpers. Besides the care of the electric wagons and runabouts there are several gasoline machines stored in the garage, and these are also given such mechanical attention as is necessary.

The Electric Vehicle Association of America's monthly meeting, held Feb. 25 at the Engineering Societies' building, 29 West 39th street, New York City, was addressed by James M. Skinner, engineer of the Philadelphia Storage Battery Company, Phliadelphia, Penn., whose subject was "The Philadelphia Thin Plate Storage Battery." Mr. Skinner is a well known battery expert and his address, aside from dealing with the products of his company and giving a great deal of valuable information, was especially interesting from the viewpoint of acid battery design, construction, maintenance and care. Following the lecture the subject was generally discussed by a considerable number.

Electric Vehicle Truck, Bought in 1904, Now Hauling Tires Across a Street from Hartford Factory to Storehouse.

Tate Electric, Ltd., is the name of a company organized to build and sell electric service wagons and pleasure cars in Canada, the directors of which are Henry Timmins, N. W. Timmins, W. Scott Hutchinson, C. E. Archibold and S. Carsley of Montreal, D. A. Dunlap and A. O. Tate of Toronto. The factory and production manager is Albert Kaltschmidt of Detroit. The company is to build a factory of two stories, having 84,000 square feet of floor space, of steel and brick, at Walkerville, which is across the river from Detroit. The executive offices will be at Montreal.

SHORTEST HAUL OF RECORD.

Electric Truck Carries Tires Across a Street at Hartford and Saves Company Money.

When the Hartford Rubber Works Company, Hartford, Conn., was an independent concern and not a division of the United States Tire Company, its officials were generally residents of that city and were naturally interested in its other industries. The Electric Vehicle Company was once one of the most prosperous concerns in Hartford, and the spirit of cooperation and promotion resulted in the purchase of an Electric Vehicle five-ton truck in 1904, which was used for all manner of transportation. The machine was for a long time worked in freight haulage and in express cartage, and the results were in every way satisfactory.

But there came a time when those directing its use believed that the electric was not as economical for general work and it was laid up for a considerable period, and then offered for sale, for in the opinion of the official of the company supervising the transportation it was somewhat antiquated, as trucks go. The storehouse of the plant is across a street from the factory and the distance from the entrance of one to the entrance of the other is perhaps a couple of hundred yards. With the utilization of the storehouse it was necessary to carry the tires, and because they are not packed each shoe must be handled individually. It was realized that this transfer was costly and economy was essential.

The old truck was thought of. It was looked over and made ready and then it was given a steady assignment running between the factory and storehouse, carrying five tons or more each trip if desired, and making about 20 round trips daily. The machine might be made to do more work, but this is all that is required of it. The five-ton loads have brought the cost of handling down very low and aside from the driver the expense of operation is small. The company makes its own current and the truck is charged every alternate night. Instead of being regarded as a relic and of doubtful value it has been found to be a very desirable property, and the means of a considerable economy. So far as appearance goes the machine is not unsightly and there are but little evidences of wear.

The street department of Worcester, Mass., is using a 1000-pound Detroit electric wagon that is giving excellent satisfaction.

ELECTRIC VEHICLE PRACTISE.

Typical Chassis Frames, Designed for the Installation of Differing Methods of Power Transmission, and Their Characteristics---The Practical Results of Scientific Engineering, They Are Long Enduring Constructions.

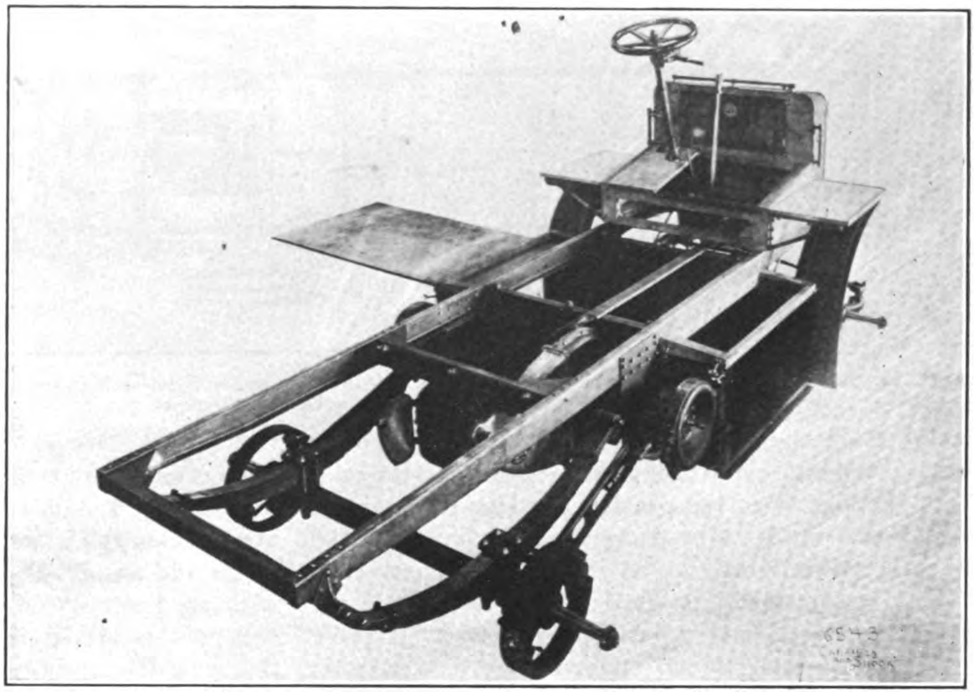
By William W. Scott.

THE electric vehicle represents scientific development and progression in the broadest sense. More than a quarter century has elapsed since the practicality of such conveyances was established and while it is certain enough that many of the characteristics of animal transportations have been retained there is no doubt of the application of well founded engineering knowledge. The original purpose of many who conceived motor vehicles was to adapt a means of propulsion to carriages or wagons, and with rare exceptions there was no disposition to construct what might be better suited to endure the heavy weights and stresses of road conditions. In fact, if the power wagon of today is analyzed one will find that it is surprisingly similar to the animal vehicle. But if comparison be made of the earlier and the present day constructions the application of engineering principles will be evident in every detail.

There is now no absolute standard of electric vehicle design; that is, what is admittedly superior from every viewpoint, and there are numerous means of propulsion that have been well tried and adopted because of the confidence of the builders in them, but there has been no test of these machines under uniform conditions that would establish any one of them as better adapted for given purposes. Throughout the history of the gasoline motor wagon or carriage manufacturers and owners have engaged in varying forms of competitions, racing, endurance contests, fuel consumption trials, hill climbs, braking tests, economy runs and so on, all of which have been conducted with recognized regulations or conditions or to special rules, and under careful observation, for the purpose of determining superiority.

Admittedly a great deal of such data is worthless, because of the difference in capacity of the drivers, the resources of those competing, the character of preparation and the application of technical interpretations of the rules, but these tests have very largely shaped the policies and the endeavors of engineers. The use of power and the attainment of high speed has been a very general result with pleasure cars. With the building of gasoline vehicles for haulage the passenger chassis were often utilized in those first placed in the market, and from these the present types have been developed.

The electric vehicle, especially the service wagon, is an evolution from the pleasure cars, but the development has been along different lines. No tests or trials have ever been conducted in this country, and the machines have been brought to their present day efficiency through observation of actual service under all conditions of use, and the data that have been utilized by the electric wagon designers have been absolutely well established. There is no question that the process is much slower and undoubtedly more costly, for it has been necessary to continue the observations for long periods, but it has the quality of being based on practise and is not founded on the work of specially prepared vehicles handled by experts.



Chassis of Urban Delivery Wagon with Transversely Mounted Motor and Double Chain Reduction, with Battery Box Cover Withdrawn and Motor Case and Dash Compartment Open.

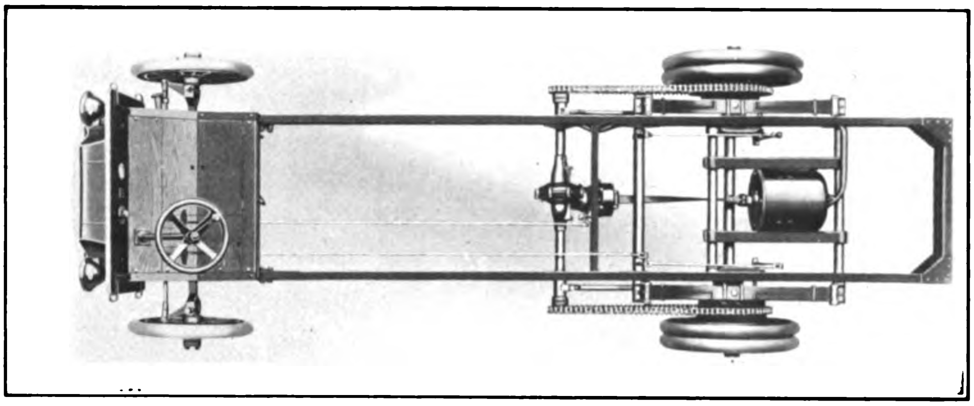
When the statement is made that the electric service wagon is well designed it is not meant that all are equal, but it is intended to emphasize the fact that they are all dependable and reliable. In the first electric pleasure vehicles numerous means of driving were experimented, and some of these were in every way commendable, although given over for what may be

regarded as simpler construction. There are no less than nine different methods of drive employed by designers, whose machines are considered to be standard, but of these but two are used by the majority. This statement is made to emphasize that the means for transmitting power have been seemingly satisfactorily established.

The designer of the electric wagon chassis has not met the same problem the gasoline vehicle engineer has been required to solve. The electrical engineer has seldom undertaken to build a motor. The motors produced by the great electrical manufacturers do not represent the work of the individual. To the contrary they are the productions of splendidly organized engineering staffs, composed of experts of recognized ability, and having unlimited resources and the best of facilities for experimentation, and it is fair to assume that motors designed and built with the latest and most approved tools and shop equipment and by highly skilled labor can be regarded as dependable and reliable. That the engineer has generally used motors so perfected and specialized is an assurance to the public of the quality of the construction, for it is evident enough that until a type is certain to endure and give the rated power it will not be offered in the market.

The motors made by the large manufacturers are sold at much cheaper prices than would be possible were they made in limited numbers, and it is possible with the use of standard productions of this kind to materially reduce the first cost and to minimize the expense for restoration and repair.

The motor vehicle designer does not manufacture batteries. While it is true that one or two firms will build batteries, these are not necessarily a part of the regular equipment, and the products of large concerns that specialize battery making are generally installed. Standard batteries have approximately the same capacity. That is, the same size and type of any given make will yield about the same power, and with conservative rating it is practical to establish a mileage that can be realized with certainty. Batteries have been developed by the manufacturers just as the motors have been perfected, because it has been realized that minimized initial cost, the greatest endurance, increased capacity, and economy of maintenance are material factors in stimulating more increased use, and it might be pointed out that the evolution of both motors and batteries has been accomplished by patient test and observation and not through competition or trial.

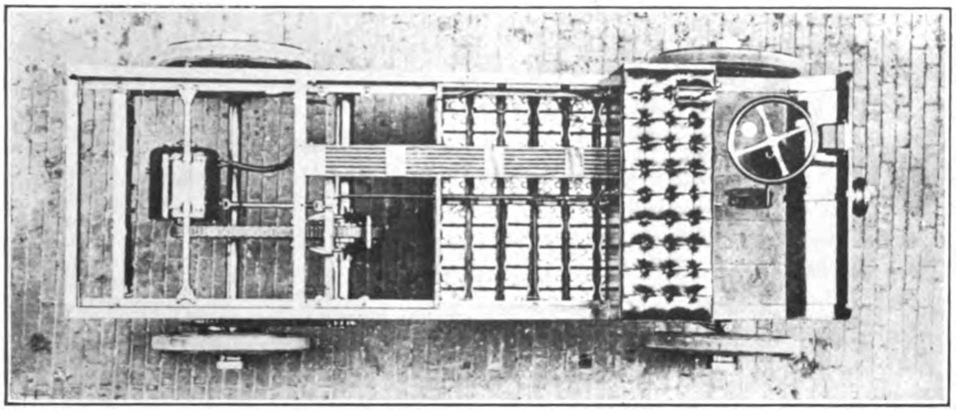


G. M. C. Chassis, Stripped of Battery Box, Showing the Flexible Shaft Drive and the Single Chain Reduction, the Motor Being Supported by a Frame.

The electric vehicle engineer has worked out his problems by a process of elimination. He has realized that he has a definite motor capacity and that a certain energy can be stored in a given type of battery. As the vehicle must carry the battery, and as power must be used to cause propulsion, the purpose has been to minimize the weight of the chassis and body and conserve the energy. In addition the frictional losses have been reduced through the use of roller and ball bearings, by the protection of chains by encasing them, by enclosing and carefully lubricating moving parts, by insuring against excessive wear and providing means of adjustment, and greater utility has been secured by protecting the power wiring, by minimizing current consumption under different conditions of operation, and by safeguarding against accidents resultant from excessive work or from careless or negligent use.

In the conservation of power not a little attention has been directed toward the perfection of spring suspension, for a great deal is dependent upon the manner in which the load is carried. The influence of springs is governed by their form, design, the material of which they are constructed, their elasticity, manner of installation and means for lubrication, and the weight carried. The weight to be supported and its distribution is probably the most important factor, and it is necessary to have springs that are sufficiently elastic to minimize the stresses of road shock and absorb the resistance to tractive effort, and with such strength that they will not have excessive deflection or reflexion. It is well known that a vehicle that has slow spring action is much easier riding and much more economical of tires than one with quick movement, and to obtain springs having this quality much careful experimentation is often necessary.

The majority of designers have located the battery cradle under the chassis and between the wheels for several reasons. First of all this location affords a low vehicle centre of gravity, and while electric wagons are not generally driven fast this quality decidedly lessens the strains upon the chassis when loaded and when making turns. Not only this, but it insures a much easier riding machine and better protects the loads. In some instances the batteries are carried on the chassis frame and very largely upon the forward springs, it being maintained that this construction will afford a well equalized distribution of the weight and not bring an excess load upon the rear construction. The underslung battery gives the full length of the



Columbia Chassis, 2500 Pounds Capacity, with Double Chain Reduction, the Silent Chain Not Enclosed and the Cover of the Battery Box Drawn to Expose the Trays of Cells.

chassis for the body, and with the battery above the chassis frame there is some reduction in the space that is available.

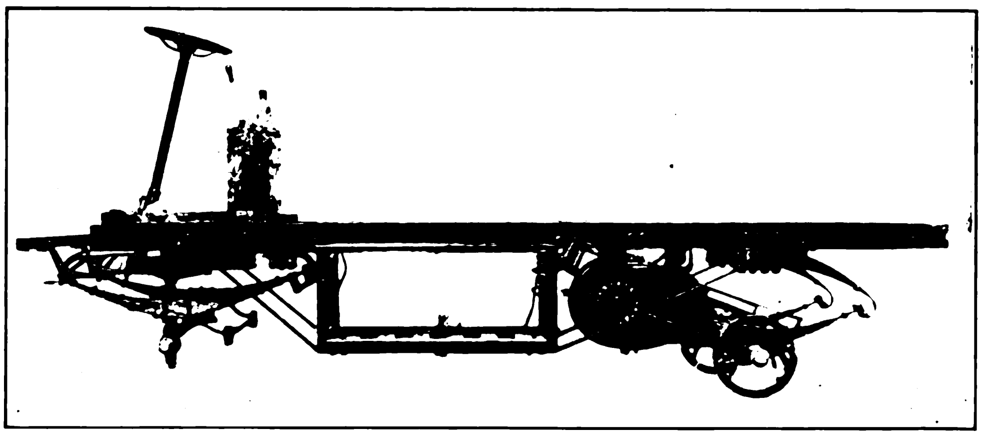
The underslung battery cradle is usually constructed of steel angles for a frame with the box itself of wood or a composition, but wood is the standard material. In some instances the wood is chemically treated to resist the action of the electrolyte that may be drained from a leaky jar or slopped from a cell, and generally there is a series of cleats on the bottom on which the trays of cells rest. With some boxes the bottom is removable, being retained by latches that clamp it firmly, so that when the latches are released the bottom and the trays may be lowered or dropped out of the cradle. Such construction requires a pit with an elevator or jack over which the machine can be driven, the battery lowered, the vehicle pushed away, the battery raised and placed on a truck on which it may be taken to any portion of the garage. This process is reversed for the restoration of the battery or the substitution of another.

With the other type of battery cradle the sides are removable, some being retained by wing nuts or latches or other means, and when taken off the battery trays may be drawn out onto trucks and transported wherever desired. In several instances the sides are hinged at the bottom so that they may be lowered to the level of the bottom, and with one construction at least the sides are supported at that level so the trays may be drawn out upon them, this affording a convenient means for examination. The battery boxes are necessarily provided with drainage in the event electrolyte is spilled, and with ventilation to allow the gas to escape, and to minimize the temperature, for batteries will frequently require the cooling influence of a free circulation of air, especially in warm weather.

Battery boxes are ordinarily covered, there being usually several inches clearance between the top and the trays to insure sufficient ventilating, and the cover is often made so tight that it will effectually drain water and prevent dust sifting into the battery box. Dust or any foreign substance that will cause deterioration of the electrolyte and lessen the efficiency of the battery, as well as oil or water, or possible drainage from anything carried in the body, is guarded against by the tight covering of the battery. Under ordinary circumstances the top of a battery box cannot be reached save by removing the body, and this is a work requiring time, even with good facilities.

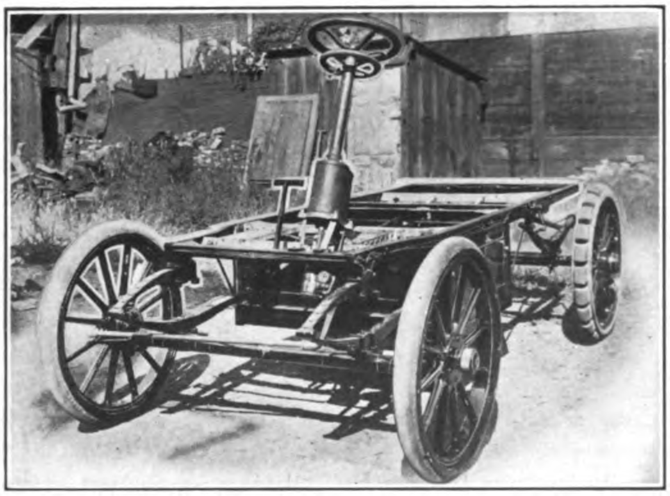
A detail of decided importance is the dimensions of the chassis frame. Because of the desire to minimize weight the material must be high grade and so proportioned as to insure the greatest strength, and it must be reinforced with gussets and cross members. It must resist the weight of the battery suspended from it, but it must sustain the load carried upon it. From one point of view the battery cradle materially stiffens the frame, for the box extends beneath it where there would be a possibility of buckling from the upward thrust when brakes are applied at the rear wheels when moving at a comparatively high speed. Extending from side to side of the frame there is also a resistance against the distortion that would ordinarily be expected with a gasoline vehicle chassis, and with the underslung battery cradle but a small part of the frame is given over to the seat and footboards. The loading space of a given length can usually be afforded on an electric vehicle of comparatively short wheelbase, and the chassis frame is correspondingly shorter. The smaller wheelbase and the comparatively reduced frame do not require as heavy material, and with a high grade steel the weight is minimized.

Spring installations vary somewhat, there being full elliptic springs used on the smallest and lightest



Side View of Waverley Mail Wagon Chassis, Driven by Transversely Mounted Motor and Double Chain Reduction; the Battery Cradle Empty and the Controller Box Exposed—With This Type the Frame Is Trussed.

types of wagons, and while the semi-elliptic type is very generally used, in one or two instances a platform construction has been adopted for the rear. For wagons in excess of 1000 pounds capacity semi-elliptic springs are usually used. The custom where semi-elliptic springs are employed is to secure the forward ends to eyes in the spring horns of the chassis frame and to shackle the rear ends, the drive being through the master leaves of these springs. Practise varies with similar springs for the rear, these sometimes being with the forward ends fixed in spring hangers and the rear ends shackled, or to shackle both ends. In one construction where full elliptic rear springs are used these are mounted so that they have a longitudinal movement in guides at either side of the frame when compressed or released, this eliminating the strain that they would otherwise be subjected to under load when road shock is experienced. With practically all



Chassis of Commercial Worm Driven Light Wagon, Showing the Three-Quarter Elliptic and Platform Spring Suspension, the Steering Gear and the Controller Covered by a Housing on the Base of the Steering Column.

of these the driving thrust is taken by the radius rods that extend from the rear axle to the sides of the chassis frame. Sometimes the forward ends of the radius rods are connected to separate hangers, and generally the connection is made to the hangers that carry the jackshaft when the double chain drive is employed.

The location of the motor in a chassis is extremely important. First of all it is desirable to have the machine so installed that it will be least affected by the road shocks, and it is also necessary to have it well anchored that it may have maximum power productiveness. The double chain reduction, so-called, means a single chain from the motor to the jackshaft sprockets and side chains from the jackshaft to the rear wheels, and with this the motor is installed transversely from a cross member of the frame. With some constructions radius rods extend from the motor case to the rear end of the frame or to a cross member. With others the relation of the motor and the jackshaft is preserved by the heavy chain case that houses the first reduction chain and the sprockets. Generally this is a silent chain and it is operated in an oil bath.

With this construction the motor is located above the rear axle, where it is protected against excessive chassis distortion and the fullest action of the springs minimizes jars and jolts. The movement of the entire assembly is without stresses, and the driving thrust is taken by the housing of the jackshaft from the radius rods.

When the drive is by shaft direct from the motor to the jackshaft the motor may be either in front or in back of the jackshaft, but as a rule the machine is carried in a cradle over or in back of the rear axle and the shaft extends with one universal joint to the motor. The effect of this suspension is practically the same as the other, but the motor is anchored in the cradle or frame and motor radius rods are unnecessary. In one light wagon the motor is mounted forward under the driver's seat and the long shaft extends back to the jackshaft, the battery cradle being divided so as to allow space for the shaft.

In two types of light wagon the worm drive is used, and with the one the motor is mounted on a cradle, formed of the radius rods, that is shackled to a cross frame member so the vertical movement of the axle is not restricted. The drive is direct from the worm shaft coupled to the motor armature shaft to the worm wheel, in which is incorporated the differential. With the other type the worm shaft is carried in a housing incorporated with the rear axle shell, and the shaft extends forward to the motor that is assembled with the axle housing and which is suspended in the chassis frame. Still another construction has the motor mounted on a cross member and the pinion on an extension of the armature shaft drives the bevel gear of the jackshaft.

With all of these the motor is installed under the body and with the one exception of the worm drive first referred to the machine is carried by the frame. There is one other in which the motor is similarly carried transversely under the body of a light wagon, and the drive is from this by a silent chain to a countershaft that has two universal joints, that parallels the motor armature shaft. The other end of the shaft drives a herringbone gear that meshes with a similar gear on a full floating rear axle. The two universal joints in the countershaft permit the movement of the body.

Turning to other motor installations, there is one in which the machine is contained in a hollow shell that constitutes a rear axle of the full floating type. The armature shaft is hollow and at one end of this shaft is a differential gear. The driving shafts are of two lengths, one of them extending through the hollow armature shaft, and both are secured to the differential. Pinions on the ends of the driving shafts drive two large idler gears that in turn mesh with racks in the inner peripheries of the disc or flange rear wheels, and there is a double reduction by this gearing, the idler wheels being carried by fittings on the ends of the axle housing.

In another construction two motors are used, each of which is fixed in a frame rear axle. Between the

motor and the wheel is fixed a gearcase. The end of the armature shaft carries a pinion that engages with the largest diameters of three gears mounted on studs carried on an extension of the motor case that serves as an axle, and the smaller diameter gears engage with an internal gear in the case. The movement of the motor armature shaft gives the three gears a planetary motion within the fixed internal gear and turns the shaft on which the three gears are mounted, which is secured to the wheel hub cap. This same concern builds a truck driven by all four wheels. The motors are fixed in the rear axle and pivoted in the front axle, and connected so that the machine is steered in the usual manner through the front wheels. The outer end of the motor case is a heavy plate that carries an axle spindle on which the wheel is mounted. Between the motor case and the plate is a large gear carried on a heavy stud. The armature shaft pinion engages with this gear. The hub of the gear is formed as a pinion that projects through the cover plate and engages with the internal gear of a drum bolted to the wheel. The wheel is mounted on taper roller bearings and its relation with reference to the gear is perfectly maintained.

Another form of wheel drive is by motors mounted horizontally on the ends of axle stubs that are fitted with disc wheels. The inner disc has a large bearing on the axle stub. The motor armature shaft is in length the diameter of the wheel and carries at either end a pinion. In the outer circumference of the discs are racks and the pinion at one end of the shaft engages with one rack and the other pinion meshes with the other. As the armature shaft is turned the driving effort is transmitted to the racks. These axle stubs are pivoted in knuckles and the machine may be steered by the forward wheels only when driven by these wheels alone, or by all four wheels when four motors are used.

It will be noted with the motor in the rear axle, or with motors assembled with the axles or in the wheels, that they are not protected from the road shocks by springs, but these are surprisingly enduring and long periods of service do not develop abnormal wear.

The power wiring, from the battery to the motor and controller, is well protected, sometimes by metal or fibre ducts, sometimes by wood channels, to insure against wear of the insulation or breakage. The controllers are usually of the continuous torque type and are designed to give four or five speeds forward and two in reverse. Locations differ, some being under the seat, some under the floorboards, some assembled with the steering column, and the control may be by hand lever on the driver's seat, on the floorboards and resembling the conventional brake lever, or on the steering post.

Steering is by the conventional hand wheel and varying forms of gearing and linkage, and one or two brakes may be used. If one only, this is generally on the rear wheels and may be either the internal expanding or the external contracting type, but if two, if both are not on the rear wheels, the second may be on the jackshaft, transmission or driving shaft.

The designers have very generally planned the chassis so that every component that may require attention is accessible. Release of cover clamps gives access to the commutators and brushes of the motors, and comparatively little care is required aside from lubricating the bearings and adjusting the brushes. The battery boxes may be opened quickly, the controllers can be reached in a few seconds, the silent chain cases have ample handholes through which adjustment may be made when needed, and in going over the chassis the extreme simplification is a reason for surprise. There are no reciprocating parts, the means for lubrication are ample, the wearing surfaces are large and there are abundant factors of safety.

The outline given of chassis has been with a view of showing the different constructions and power applications, and to emphasize that while designers have very generally differed as to detail there are certain factors on which they are quite agreed. There is no doubt that the use of high class material, making possible extreme strength and lightness, the scientific assembling of the chassis and its components, the perfected motor, the highly efficient battery, and the careful attention to conservation of current, all the developments from service and long continued practise, have resulted in highly perfected vehicles. It is not meant that the limitations of progression have been reached, for this is far from being the case, but it is absolutely certain that electric wagons as now offered to the people can be relied upon for much more than is claimed for them.

(To Be Continued.)

The Spencer Wire Company, Worcester, Mass., has in service a 3000-pound Detroit electric delivery wagon, which is used for city and suburban haulage of all kinds. The company produces bookbinders' wire and much of this is shipped, requiring frequent trips between the factory and the shipping terminals.

The American Express Company has in its service at Los Angeles, Cal., two Baker two-ton wagons that are fitted with the standard body equipment adopted by that concern. These have been in use since about the middle of October and on routes too long to be covered with even two horse wagons, for the average mileage is from 35 to 40 daily. The machines are kept at the stable of the company, where a charging panel has been installed, and the attention necessary is given by the employees.

The Empire Electric Vehicle Company has been formed at Owego, N. Y., which is to manufacture electric service wagons and, probably, pleasure carriages. One of the promoters of the enterprise is Theodore D. Gere, who was for more than a year one of the receivers of the Champion Wagon Company of Owego, who has been convinced of the possibilities of the electric vehicle and has interested several others who have joined with him in the formation of the company.

ANNUAL "EXIDE" DINNER.

Vehicle Manufacturers, Dealers and Agents Guests of Electric Storage Battery Company.

A company of 220 assembled at the Mid Day Club, Chicago, Ill., the evening of Feb. 5, the occasion being the annual dinner tendered by the Electric Storage Battery Company of Philadelphia, Penn., to electric vehicle manufacturers, electric vehicle dealers and Exide battery distributors, practically all of the leading concerns of the industry being represented. The invitations had been very generally distributed and this brought together men from nearly every state and principal city in the nation.

The sales managers and department heads from the different offices of the company constituted a reception committee that received the guests, and after a period of fraternizing a dinner was partaken of. The menu was tempting and to it the company did full justice. In the unavoidable absence of Herbert Lloyd, president of the Electric Storage Battery Company, Charles Blizard, third vice president, presided. At the conclusion of the dinner a programme of vaudeville entertained the guests.

The Annual Dinner Given at the Mid Day Club, Chicago, Ill., to Electric Vehicle Manufacturers, Dealers and Exide Battery Distributors, by the Electric Storage Battery Co.

The Electric Storage Battery Company is known as the oldest concern in America making storage batteries, and its products are generally used by a very large percentage of electric vehicle manufacturers. The annual "Exide" dinner is regarded as being one of the enjoyable features of the automobile show week at Chicago.

At the service wagon division of the Boston automobile show eight different makes of electric vehicle will be exhibited, and one of these, the Edison, for the first time.

SHIFTS CARS WITH TRACTOR.

Pennsylvania Railroad Replaces Horses with Big Electric Machine at Jersey City.

An electric tractor of very large capacity, built at the shops of the company at Altoona, Penn., from designs by P. A. Buckwalter, chief electrical engineer of the company, has been placed in service at Jersey City, N. J., where it is used to haul cars through some of the streets. Several large concerns receive frequent consignments of freight in carloads, and it has been the custom for years to deliver these cars by hauling them on tracks laid in the streets. Because of the conditions locomotives could not be used and horses were not satisfactory in hot or bad weather, and occasionally tackle was used to perform the work. Several short curves limit the speed of the cars. Heavy trucks were tried in the place of horses, but none was of sufficient weight. The railroad company then undertook to build a tractor, and the result is the Buckwalter machine, which has proven very satisfactory.

The tractor is 22 feet length and the tread is 72 inches, so that with the 10-inch tires the extreme width is approximately 92 inches, the machine being designed to be driven with the wheels outside of the rails. The wheelbase is 144 inches and the wheels are 60 inches diameter. The weight is 28,850 pounds. The tractor is driven in either direction without turning and it is steered and driven by all four wheels. The big steel wheels are mounted on steering knuckles and on each wheel is fixed a large external spur gear. Two electric motors, having nominal ratings of 10 horsepower, but with an overload capacity of 250 per cent., drive through spur gearing giving a double reduction to the two jackshafts. These jackshafts are carried in heavy bearings and have the usual differentials, with universal joints at the outboard ends, so that the spur pinions mesh with the external gears on the wheels. The pinions just clear the wheel rims, there being a large reduction by the driving gearing, and the relation between the axles and the jackshafts is such that a line through the centre of a steering pivot will also pass through the centre of a pinion, insuring positive driving effort.

The chassis frame is suspended on semi-elliptic springs and under the frame is carried the Edison 80-cell battery. This has a capacity of 450 ampere-hours and the tractor has a mileage under normal conditions of about 40 miles, with a maximum of eight miles an

hour. The chassis carries a large cab body with side and end windows, and in this is a steering wheel, which is mounted as is that of a vessel, and is operated by the spoke ends. This affords more certain control than the usual type of steering wheel used for automobiles. The hand levers are located at either side, one full set at the right of the driver, no matter what the direction of movement of the machine. The speed lever swings in the slots of a quadrant that are divided by a bridge, there being three speeds forward and three in reverse. Going in one direction, to illustrate, the forward movements of the lever give the different speeds, and when the lever is brought against the bridge it is in a neutral position. To reverse the lever handle must be changed to the socket on the other side of the bridge and the backward movements give the different ratios. It is impossible to reverse the tractor without this change of the lever and unintentional or accidental reversing is insured against. The tractor is fitted with an air brake and the usual couplings, and the pressure is supplied by a motor driven pump. When the air brake is used the control lever is thrown into neutral position. There is a hand brake that is operated by a wheel located in the cab. The tractor is fitted with standard automatic drawheads that may be uncoupled by outside levers, and these are cushioned by pneumatic cylinders that will sustain 10,000 pounds pressure before the pistons will be forced to the bottoms. The tractor wheels are fitted with steel rims on which are installed the rubber block tires, there being sets of three blocks on steel bases arranged in two rows. The tractor is practically noiseless and is so well suspended that it rides very easily, even over the tracks and the paving.

WESTINGHOUSE CHARGING PANEL.

Sectional Equipment That May Be Increased to Meet the Demands of Garage Business.

The Westinghouse Electric & Manufacturing Company, East Pittsburg, Penn., has produced a charging panel now ready for marketing that is designed to meet the demands of those who have comparatively small space and yet desire to increase facilities whenever this may be desirable. The ordinary charging panel consists of a slate tablet on which are installed the switches, the ammeter and voltmeter, and the fuses, and which is connected with a rheostat located conveniently, either on a shelf or gallery or possibly on the floor. Very general construction is to place the rheostats side by side on a shelf and to have the panels, often designed for from four to six batteries, erected side by side, forming a continuous board of considerable length.

The Westinghouse equipment differs from this in that the panel frame carries two boards, both small, the one at the top carrying the meters and the lamps, switches and connections, and the lower the fuses. With the two sections two batteries may be charged simultaneously, but it is possible to place between these two as many additional sections as may be desirable, the only limit to height being the space and the convenience in reading the meters, making the connections, etc. Back of the panel is a frame designed to carry two rheostats for each section, and as the panel is increased in size rheostats are also added. This construction makes it possible to install a charging equipment that will be sufficient for from 12 to 16 batteries in practically the same room that would be necessary for from four to six, and at the same time to economize the initial cost, as the panel may be increased at comparatively small expense.

The panel may be used by connection with the main line if the current is direct, but if it is alternating then a motor generator set is necessary. Or it is possible to generate current with a generator driven by a steam or gasoline engine.

EXCLUSIVE ELECTRIC GARAGE.

Second Public Station, with Capacity of 30 Machines Opened at Hartford, Conn.

The second exclusive electric garage has been opened at Hartford, Conn., by the Sigourney Electric Garage Company, at 117 Sigourney street, in a building especially built for the purpose, which has a capacity of 30 vehicles. The Hartford Electric Light Company for a number of years maintained its own garage and incidentally gave service to a number of owners of electric vehicles, but when the company became agent for service wagons and began to promote the sale and use of such machines it afforded to its customers so far as possible garage attention.

The Sigourney Electric Garage Company will afford service to both pleasure and service wagons and is located in what may be regarded as a residential section. The building is 100 feet length and 35 feet width and admirably lighted, with entrance at either end. The floor is cement and is so built that it may be frequently flushed. The charging equipment will give simultaneous service to 16 vehicles, and up to a 56-cell battery. The current is supplied by the regular commercial mains and as it is alternating it is rectified, the rectifier being installed on the roof girders to economize the floor space. Later on it is proposed to install a motor generator set, which will be more economical than the present equipment, and will better serve the requirements of the management.

The garage is well equipped throughout, being heated by hot water, and an air compressor affords a vacuum cleaning service that is especially effective in cleaning cloth upholstered vehicles, to say nothing of the other uses that may be made of it. The president of the company is C. H. Brooks, who was formerly with the Westinghouse Electric & Manufacturing Company at Pittsburg, Penn., and W. J. Gengras is treasurer and secretary. The garage has been well patronized and the prospect for the future is excellent.

TIRE ECONOMY AND TIRE NEGLECT.

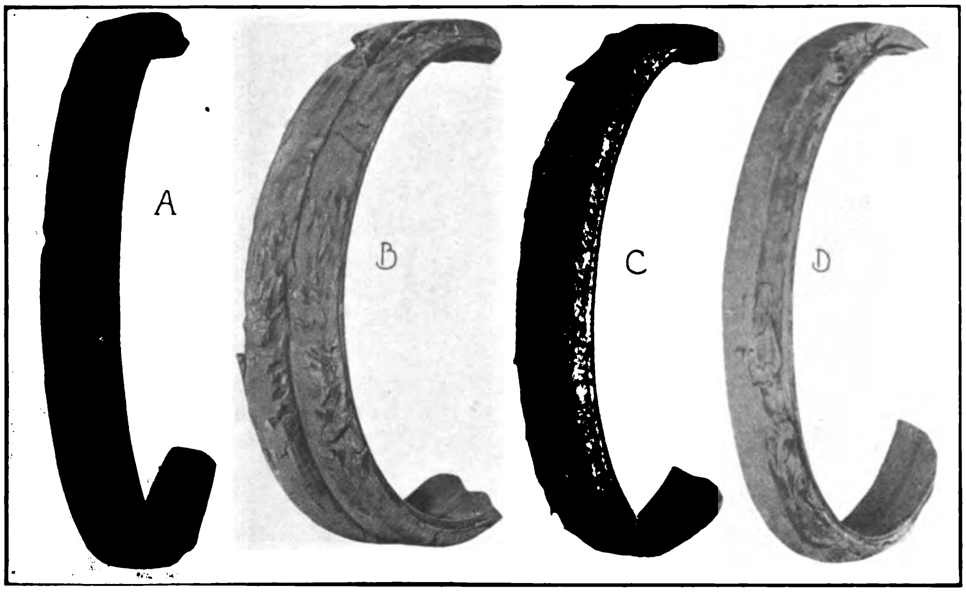
Wheel Shoes Designed by Maker and Engineer for a Stated Work and Mileage, and Are Usually Adequate---Consequences of Overloading, Careless Driving, and Innumerable Other Conditions Within the Owner's Control.

THE endurance and service of tires is given a very large degree of attention by the owner of a motor wagon or truck, so far as the expense for renewing equipment is concerned, and it may be said that, with the usual form of guarantee by the tire manufacturer, this is represented by mileage, but it is seldom that the men who are so solicitous as to the cost a mile will insure themselves the maximum of results. This is not through ignorance of causes for abnormal wear and deterioration, but generally because of neglect. There may be exceptions to this, but such are comparatively few.

Tire equipment is ordinarily determined by the manufacturer of tires, and it can be said that the custom is for the designer of a motor vehicle to estimate the weight of his machines and to determine the size of the wheels that shall be used. It may be that the advice of the tire expert is sought and the wheel builder consulted, but generally the vehicle engineer decides the sizes of the wheels on the basis of what is regarded as standards. To illustrate: Many of the makers of tires have in tabulated form the maximum weights that should be carried by wheels and shoes of differing circumferential and cross section diameters. These are prepared from estimate and experience and are considered to be desirable.

The designer of a vehicle will estimate the weights and with such a tabulation determine the size of the tires to be used. To carry such a tire a wheel has been estimated. It is known that from 60 to 95 per cent. of the load may be borne by the rear axle, and in addition to the weight of the chassis and the load there is to be provision made for the tractive effort. The stresses are proportionate to the weight supported by the tires, but while the front tires must endure the road shocks the rear shoes must be sufficient to resist the traction and braking strains.

It is general practise to have truck rear tires of a dual type with from 50 to 100 per cent. greater width than the front shoes, and with light service wagons the equipment may be of the same sectional area, though frequently the rear tires may be somewhat larger than the front. Assuming that the wheels have been designed and the shoes determined by the engineer creating the machine, it is reasonable to believe that the normal sizes have been provided because expense is to be considered. There are instances where what may be believed to be extreme sizes have been specified, but these are not frequent.



Causes of Tire Destruction and the Results: A, Use of Non-Slipping Anti-Skid Chains; B, Torn by Skidding or Locking of the Brakes; C, Worn by Driving at Excessive Speed; D, a Consequence of Overloading.

The selection of tires may be regarded from two aspects. The one is to choose a normal dimension from the front and the rear wheels, basing expectation of a stated service on the price paid, or to specify larger sizes and expect correspondingly greater mileage. Measuring the use by the cost it may be held that there will be the same ratio of expense a mile, the larger wearing longer, but giving no greater mileage than would be expected from the difference in cost. In other words, if a certain service could be realized from one size of tires, it would be logical to have additional mileage proportionate to the expense of larger shoes. If the larger shoes showed a smaller cost a mile then they would be regarded as the better equipment.

Experience with pneumatic tires may be paralleled with solid shoes. One of the best known of American pleasure cars has always been equipped with large tires, and two of the strongest claims made for this machine have been easy riding qualities and minimum tire expense. These claims have been based on practical knowledge and actual results. The mileage cost has been surprisingly low when contrasted with other makes of cars, although the initial expenditure was relatively more. The same result has been found with solid tires, and the larger the shoes the better the en-

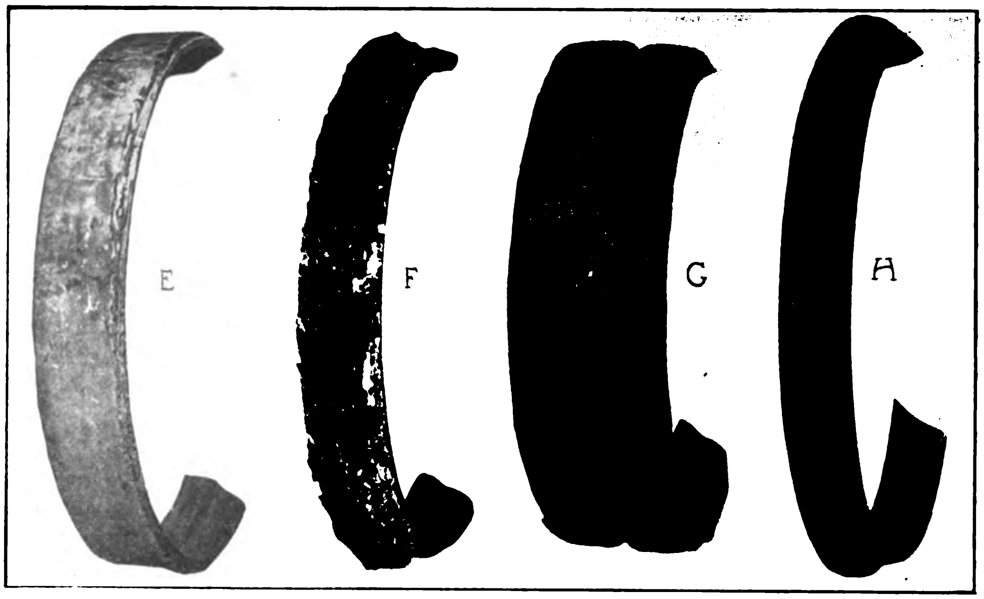
durance. The reason is only what could be expected, for the increased size of the wheel means greater wearing area a revolution, there is lessened influence of road surface inequalities and obstructions, there is a longer lever arm and consequently more effective tractive effort and lesser traction strains, greater efficiency in braking, and, quite as much as any other factor, decreased effect of use upon the mechanism.

It is customary for tire manufacturers to guarantee service in mileage, and while this is a measure that may be reasonably accurate and satisfactory it is certain enough that condition of road surfaces is a very potent factor that cannot be considered as average. By this is meant that a tire will wear much faster on a rough highway than on a smooth, and to insure equal mileage of tires used on either class is not practical, although it is usually done. Besides this there are numerous other influences that are unequal, the power of the vehicle, the weight carried a square inch of tire surface in contact with the road, the action of the clutch, the action of the brakes, the judgment of the driver, the percentage of grade, both ascending and descending, to level, the speed at which the vehicle is driven loaded and unloaded, whether or not the wheel spindles are true, and the attention the shoes receive in the garage and on the road.

One of the most general causes for excessive tire wear is overloading. To understand this an instance may be assumed, that of a three-ton truck. The tires are provided by the manufacturer and the wheels equipped after the designer or engineer has determined the weight of the chassis, and reasonable allowance has been made for a body. If the tires are what may be regarded as standard for vehicles of that capacity they are built to endure such loads as the truck is built to carry normally. If the owner of the truck wants to "make money" he increases the load from 1000 to 2000 pounds. This means the tires will carry from 16.66 to 33.33 per cent. more than they were intended by the designer or the manufacturer, and it is obvious that there will not only be wear proportionate to the overload, but it is estimated that it will be increased with the square of the extra weight, so that instead of increasing his earnings in ratio to the freight the tire expense will be quadrupled beyond the normal load. That is to say, that it will cost more to carry that fourth ton than it did the three tons, to say nothing of the extreme wear upon the vehicle from every point of view.

While it is difficult to estimate the wear that is caused by overloading it is not unreasonable to realize the fact that a tire made to endure a stated load will have a certain life. As this life is shortened by overloading, because of the stresses beyond what the tire is built to endure, the mileage must necessarily be decreased and the cost a mile increased. The overloading may not be constant, but the tire is weakened by the abnormal strains and it will deteriorate very much more rapidly than were it used within its limitations.

In tire manufacture no provision is made for variance in speed. The wagon and truck tires produced are built with reference to service, or a certain mileage under a specified load. Now it is evident that the wear is much less with a vehicle moving at six miles an hour than at 10 miles, and that slow acceleration is least destructive. Traction is obtained by weight in track vehicles, unless in the event of a railroad where it is necessary to have other means of counteracting the influence of gravity, but with motor road conveyances it is secured through the high coefficient of friction of rubber or rubber compound and the surface of



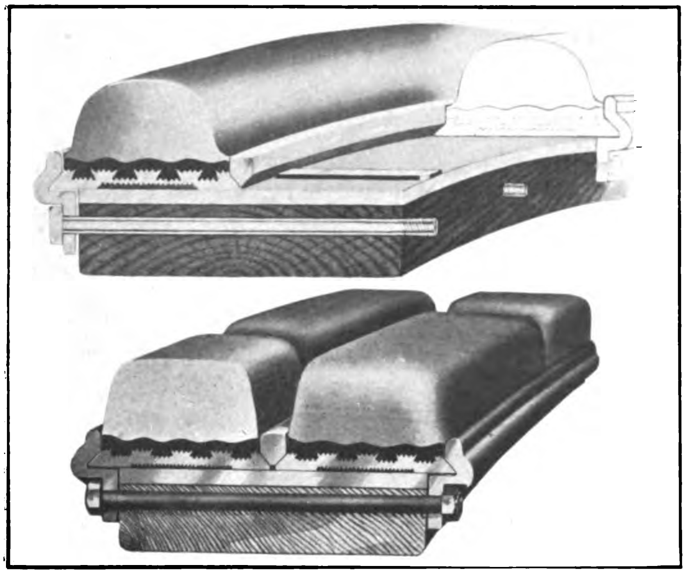
Effects of Neglect and Careless Use: E, Worn by Wheels Not in Alignment; F, Driven with Heavy Loads Over Bad Roads; G, the Results from Neglecting Cuts and Surface Damage; H, Cut to Fragments by Driving in Car Tracks.

the ground. The effect of tractive effort cannot be noted so far as the highway surfaces are concerned, but the condition of the tires may be constantly noted. This may be doubted by some. But it may be easily demonstrated.

In the event of a wheel being out of true, from a sprung spindle or other cause, and the wheel revolves irregularly, the surface of the tire will have a wavering movement on the road. While the wear resultant from a regular revolution would not be apparent the sidewise motion will be extremely destructive. There will be no greater weight carried but in a comparatively few miles the shoe will be greatly damaged. The front wheels carry the load and are pushed along. The tires of these wheels endure generally longer than the larger shoes of the rear wheels, and this from the fact that they are not required to endure the additional strain caused by traction.

Where brakes are not well adjusted and do not

hold equally it is evident that there is abnormal strain borne by one and that which is most firmly clamped will have to do a much higher work than its mate, and



The Goodrich Quick Detachable Dual Truck Tires: The Upper, the Solid Bands on Hard Rubber Bases, Vulcanized to Steel Bands, and Retained by Side and Centre Flanges; the Lower, the Rubber Blocks, on Rubber and Steel Bases, Used with the Same Rims.

the tires will be worn proportionately. If the machine skids there is a result very like that when a wheel spindle is sprung, although for a brief duration, but the wear cannot be avoided. Skidding is caused by unequal traction and when a vehicle skids it is stopped with extreme strain upon one, and never two, of the shoes.

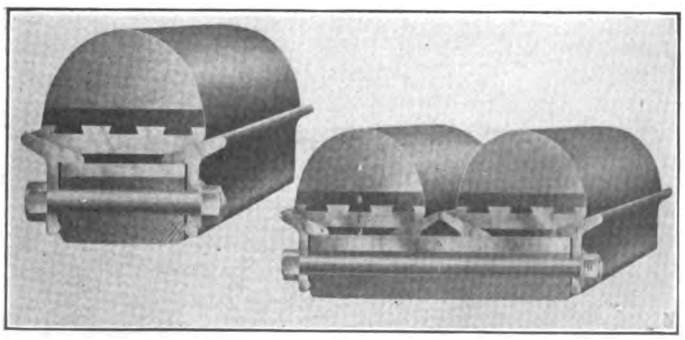
With these influences which it may be claimed cannot always be avoided, there is the factor of a load unequally distributed, which necessitates the traction wheels generally to endure strains which are as destructive as poorly adjusted brakes or skidding. One wheel must necessarily carry more weight, and sometimes much more than another, and the tire so overloaded must be worn in the proportion that it is overworked. If the brakes are well adjusted and are applied so that they grip quickly and the wheels are "locked," the tires must slide along until weight overcomes momentum, and the consequence is the extreme wear of the area in contact with the ground. The most efficient braking from the viewpoint of the engineer is to so retard the action of the wheels that the machine is brought to a standstill without skidding, and yet the slightest additional pressure on the brake would cause skidding. The most effective braking effort is made when a brake shoe is so adjusted that it will clamp the drum and retard the wheel without jar or jolt, and to do this there must be clearance sufficient for the drum to revolve freely, yet the movement of the pedal or lever should be so slight that contact is made practically the moment that pressure is applied by foot or hand. One of the greatest causes of tire wear is the poor adjustment of brakes, and this is a condition that must be known at all times when the machine is in service.

Much the same result so far as tires are concerned follows the use of a clutch that does not engage easily, or is not properly used. As a matter of fact this condition is inexcusable, for the driver must of necessity be aware of it, and besides the matter of tires there are the undue stresses to which the entire vehicle is subjected. Theoretically and practically the clutch should be so used that the machine will be started without a jar or jolt, and this use is expected by all designers and engineers. The clutch may develop a defect, but there are remedies that may be applied according to the type of device in the machine.

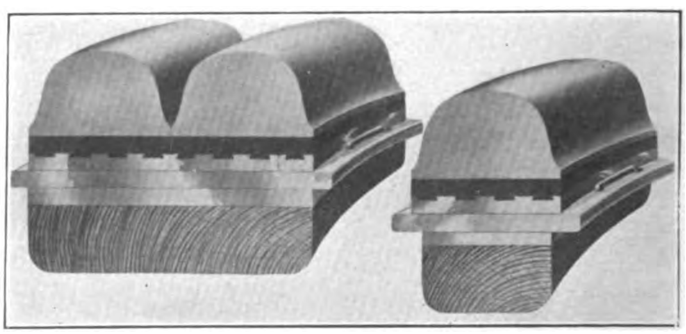
The maximum or normal load limit for tires has been established by some manufacturers, and these figures will serve to indicate the sizes on which guarantees have been established by two of the largest concerns in America. The accompanying sketches will illustrate the points at which measurements are applied.

Considering single and dual tires, it will be noted that the letters A, B, C, D, E and F are used with either, but the figure 2 is used with these designations with the dual type. The tabulations are those of the United States Tire Company, and it may be stated that the carrying capacity of these, from three to seven-inch sizes, is the same as the capacities of the B. F. Goodrich Company. The limitations are self-explanatory, and the drawings are given with a view of showing the manner of determining dimensions.

There are practically two forms of truck tires, the band and the block types, and the band is the older and the more generally used. Bands as originally constructed were with bases of fabric and were vulcanized to the channels, and clincher or straight flanges prevented the bands being "shed" should they become

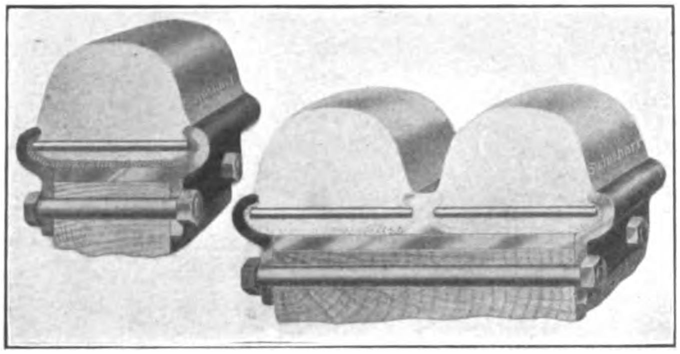


Cross Section of the United States Standard Motor Truck Tires and Demountable Rims, for Single and Dual Installations.



Section of Republic Double and Single Solid Band Truck Tires on Metal Base, Drive Fitted to Rim and Retained by Staples.

loosened. Next came the shoes with fabric base that were retained on the wheel rim by a removable flange and bolts. Tires of this type were reinforced with



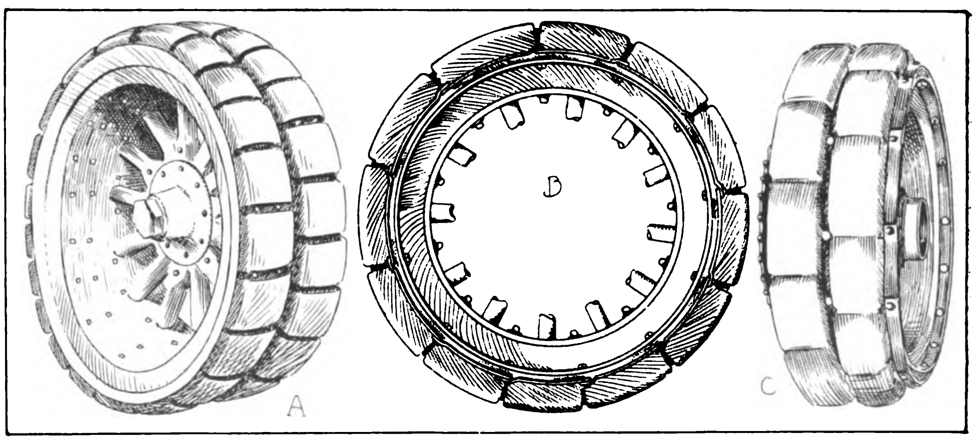
Single and Double Swinehart Motor Truck Tires on Quick Detachable Rims, the Cross Wires Engaging with the Flanges and Retaining the Shoes.

longitudinal and cross wires, with varying structural design, and with the realization that a quick detachable or demountable tire is more important with a service wagon than with a pleasure vehicle attention was directed toward development of these shoes. To-day the majority of heavy tires are demountable, but some of the equipment for light vehicles is made in much the same manner as the carriage tires, a solid rubber band being mounted in a channel with flanges that prevent stresses throwing the band from the rim.

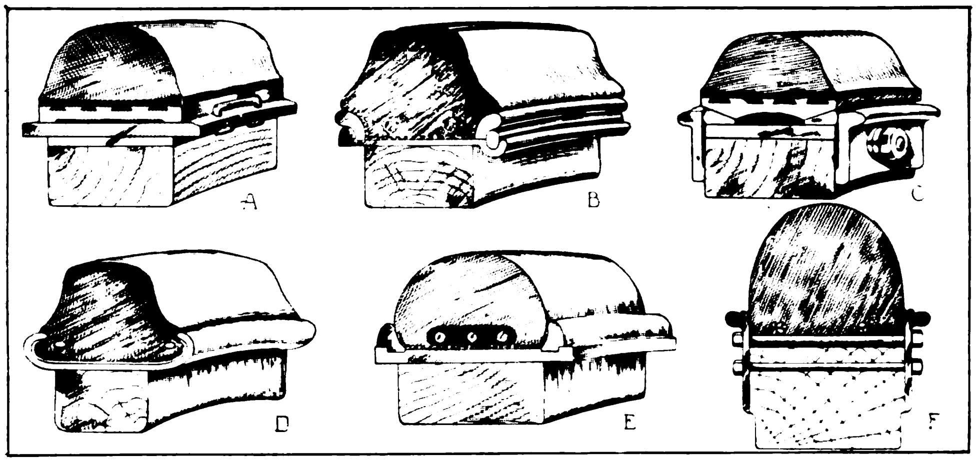
The demountable tires necessarily have a rim or channel of sufficient strength to endure under the weight supported against all road shocks, and these rims are of sizes to fit wheels of standard dimensions. In this respect the standardization of wheel rims by the Society of Automobile Engineers has been extremely beneficial for tire manufacturers, wheel manufacturers, and to those who own and operate all forms of automobile vehicles. The rims are usually a good quality of steel and while the inner circumference is generally smooth, the outer circumference is machined or formed so as to resist the stresses upon the tires. On the outer circumference and filling the channels or grooves a layer of vulcanite or hard rubber composition is vulcanized. To this the tire itself is similarly attached, the entire structure being built by the tire manufacturer and cured to the formula or by the processes which each has determined is the best. There are other methods of making service vehicle tires, some makers still producing them with the fabric and reinforced base. These, however, are not what is known as demountable, although they may be quickly removed. The one fault that must be contended in removal is the rusting of the rim, unless special provision is made to prevent rust, and then its consequent destructive influence on the tire base is a factor of large importance.

The block form of tire is with a number of blocks or cakes of rubber, vulcanized to bases of differing material, which are inserted into the specially designed rims and retained by bolts or rods, or they are retained to the rim by a collar that is bolted to it. One form of block is made with a flange about it, and between each block, transversely of the rim, is a plate bolted at either end. By the removal of a single plate it is possible to renew a block whenever necessary. While single row block tires are used, the type generally in service consists of two rows, these being designed for rear wheels, and serving the same purpose as any dual tire. When arranged the blocks lap; that is, the spaces between the block of one row are about the centres of the blocks of the other row. This arrangement provides for a cushion of rubber beneath the wheel at all times, and lessens the strain that would certainly result were the spaces in the same relation in either row. There are several forms of truck block tires where the blocks are shaped to be inserted in the rim with a diagonal relation to the face of the rim, with the length of the blocks across the wheel. With this form the wear is against the width and not the length of the block, and the space between them is somewhat wider. Such blocks have what is known as a "spiral" effect and it is maintained by the makers that they have special tractive qualities that minimize skidding. They are not made for dual tires, however.

The band tires that succeeded those vulcanized to flanged channels, which were the earliest type, were next made with bases of fabric and vulcanite or hard composition, and it was necessary that these be a very close fit to withstand the strain and to insure against creeping on the rims. This form is still used to some extent and, as may be assumed, they can only be installed on the rims by the use of special equipment, this being in one sense a press. With tires of this type there are generally several transverse channels in the rim into which ribs or beads on the base fit. These were succeeded as types by those in which wires were imbedded transversely in the base of the tire which projected beneath the clincher flanges of the rim, one flange being integral with the rim and the other being retained by bolts.



Sectional and Block Tires: A, Victor Sectional Truck Tire; B, Side View of Portage Truck Tire; C, Perspective of Portage Truck Tire.



Goodyear Single Tires: A, Metal Base Truck Tire; B, No-Rim-Cut Solid Tire; C, Demountable Single Tire; D, Goodyear-Motz Truck Tire; E, Hard Rubber Base Tire; F, Solid Endless Tire for Fire Apparatus.

Another form was that in which several stout wires were vulcanized in the base and these were brazed or connected so as to be practically continuous. The purpose of such wires is to strengthen the tire and prevent the base stretching and insure its resisting the strains of traction. Another type has a hard rubber centre or core containing several wires, but at either side is a section of rubber compound that fills the flange,channels of the clincher rim. With the demand for demountable tires the natural development was a form of rim that would retain the tire and be clamped to the wheel rim with flanges or rings, generally secured by bolts. There are tires made which have the channels so tight as to be a drive fit, and these are retained on the wheel rims by staples bent in the edges of the wheel rims, but these are not generally used.

Dual tires are, if of the band type, two shoes retained on the rim by two locking rings or flanges bolted on, with a centre ring that either fits over or under the edges of the rim channels. Generally there are wedging rings that are installed between the wheel rim and the tire channel, and when these have been forced into place by tightening the bolts the tires are held immovable. Tires of this type are held rigidly and yet may be removed readily when the bolts are loosened. It is not possible for a rim of this kind to become "frozen" with rust and it may be taken off and another installed with comparatively little loss of time.

The block tire, it is claimed, has the advantage that should any one of the sections be damaged it can be taken out and another replaced at a comparatively small cost and with but little effort, and that there is seldom the necessity of renewing more than several of the blocks. The blocks, in some makes, are so close together as to form practically a sectional tire, and the manufacturers maintain that in effect they have all the qualities of both the block and the band types that make for satisfactory and efficient service.

The following are the dimensions of leading makes of wagon and truck tires, though it cannot be said that these have been recognized as standards, for each maker has his own sizes and proportions, based on long experience, it is certain enough that these are fairly representative. Some tire manufacturers, moreover, claim that the shape and construction has as much to do with endurance as material and workmanship and methods of curing:

United States—General Dimensions, Single Tire.

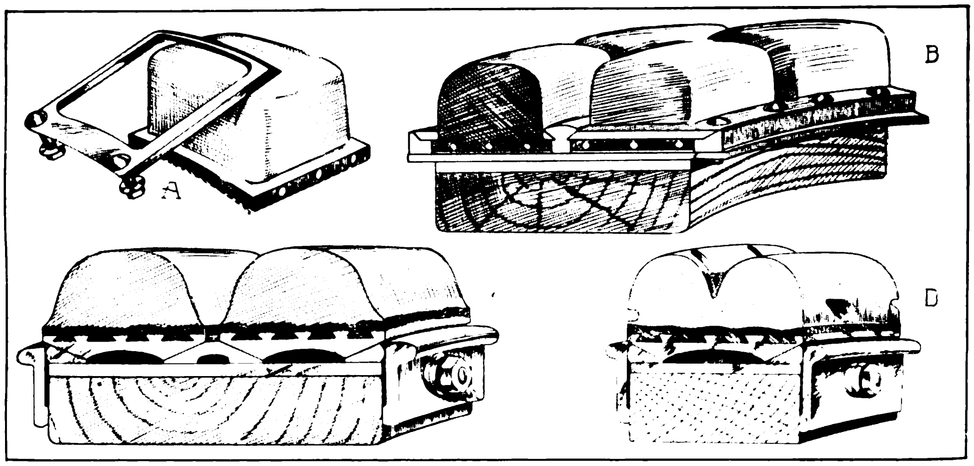
Nominal Tire Size.	Width of Tire....	Height of Tire....	Thickness of Felloe Band....	Overall Width...	Width of Felloe...	Minimum Thickness of Felloe	Flange Section..	Carrying Capacity.
	A	B	C	D	E	G	No.	Lbs.
2.5	2.5	2.3125	.25	3.375	1.75	1.25	1	650
3	3	2.5	.25	3.875	2.25	1.50	1	950
3.5	3.5	2.8125	.25	4.5	2.75	1.50	2	1375
4	4	2.8125	.25	5	3.25	1.75	2	1750
5	5	2.8125	.25	6	4.25	2	2	2000
6	6	2.8125	.25	7	5.25	2	2	3000
7	7	2.8125	.25	8	6.25	2.125	2	4000

United States—General Dimensions, Dual Tire.

Nominal Tire Size.	Width of Tire....	Height of Tire....	Thickness of Felloe Band....	Overall Width....	Width of Felloe...	Minimum Thickness of Felloe	Flange Section...	Centre Wedge...	Carrying Capacity.
	A2	B2	C2	D2	E2	G2	No.		Lbs.
2.5	5.75	2.3125	.375	6.625	5	1.25	1	3	1,400
3	6.75	2.5	.375	7.625	6	1.50	1	3	2,500
3.5	7.75	2.8125	.375	8.75	7	1.50	2	4	3,500
4	8.75	2.8125	.375	9.75	8	1.75	2	4	5,000
5	10.75	2.8125	.375	11.75	10	2	2	4	6,000
6	12.75	2.8125	.375	13.75	12	2	2	4	8,000
7	14.75	2.8125	.375	15.75	14	2.125	2	4	10,000

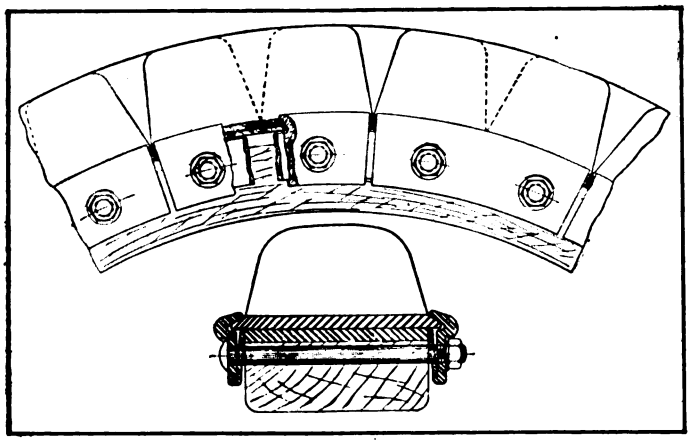
The B. F. Goodrich Company places the capacities for its three, 3.5, four, five, six and seven-inch single and dual tires exactly the same as above.

The Goodyear Tire & Rubber Co. estimates tire



Goodyear Block and Demountable Truck Tires: A, Single Block and Individual Locking Collar; B, Section of Assembled Block Tire; C, Solid Demountable Twin Tire; D, Solid Demountable Single Tire for Fire Chief's Wagon.

capacity on both cross section and diametrical size, and places limitations for speed, according to the following:



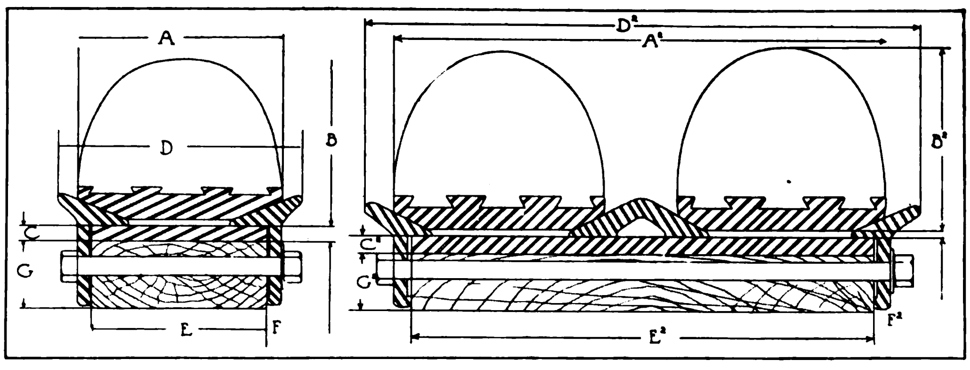
Sketch of Felloe and Rim and Cross Section, Showing Construction of the New United States Block Tire.

Size		32"	34"	36"	38"	40"	42"	Speed Miles an Hour
2"	Single	450	475	500	525	550	575	20
2½"	"	670	710	750	790	830	870	20
3"	"	900	950	1000	1050	1100	1150	20
3½"	"	1130	1190	1250	1310	1370	1430	18
4"	"	1350	1425	1500	1575	1650	1725	16
5"	"	1800	1900	2000	2100	2200	2300	14
6"	"	2250	2375	2500	2625	2750	2875	12
7"	"	2700	2850	3000	3150	3300	3450	10
2"	Dual	1125	1188	1250	1312	1375	1438	18
2½"	"	1675	1775	1875	1975	2075	2175	18
3"	"	2250	2375	2500	2625	2750	2875	16
3½"	"	2825	2975	3125	3275	3425	3575	14
4"	"	3375	3560	3750	3940	4125	4310	13
5"	"	4500	4750	5000	5250	5500	5750	12
6"	"	5625	5940	6250	6565	6875	7190	10
7"	"	6750	7125	7500	7875	8250	8625	10

The same company makes a different tabulation for dual block tires, but the capacities are based on the cross section and the diametrical measurements. It will be noted that the dual is only provided for up to width of eight inches, and that its capacity is rated as slightly less than the band tire. These dimensions are for maximum loads:

Size	M. P. H.	34"	36"	38"	40"	42"
3½"	14	2350	2500	2650	2800	2950
4"	13	3000	3200	3350	3550	3700
5"	12	4250	4500	4750	5000	5250
6"	10	5500	5850	6150	6450	6800
7"	10	6800	7150	7550	7950	8300
8"	9	8050	8500	8950	9400	9850

The only safe and certain means for tire economy is to know the exact weight of the wagon or truck. This can be ascertained by weighing either end singly, a method that is known of every weigher, and with this as a basis learn what the machine can carry up to the maximum allowed by the tire manufacturers for the equipment. Then with a load of the maximum weight the vehicle should be again weighed, which will give the proportions carried by each wheel. The difference between the weights loaded and unloaded will show what each tire is required to carry. If it is found that the weight exceeds the tire capacity it will be the best of judgment to increase the size of the shoes. This will involve the replacing of the wheel rims and the use of larger tires, an expense that may not appear justified, but it is better to make the investment in the rims, which cost but little more and may be used for years, than to believe there can be gain by using small tires.



General Dimensions of United States Standard Motor Truck Tires and Demountable Rims, to Be Used with Tabulations of Tire, Flange, Band and Felloe Sizes.

An instance of this character was brought to the attention of the writer where the owner of a truck endeavored to use eight-inch dual rear tires on a 36-inch wheel. The tires wore rapidly and instead of replacing the wheels a 10-inch rim was installed on each and tires of that width used. This was a decided improvement, but still it was believed it would be economical to increase the rim two inches more in width and use a 12-inch or six-inch dual shoe, and to strengthen the wheel rim by building in an extension to the felloe. The cost has been more than a sufficient equipment would have incurred originally and at best it is a makeshift, but it can be accepted as a fact that when a hard headed business man will twice increase the size of the tires of his truck his only interest is to economize.

MACK BURNING DISTILLATE.

California Concern Utilizing Specially Designed Machine for Handling Its Lumber Business.

One of the largest trucks used in lumber hauling in Los Angeles, Cal., is a five-ton Mack, made by the International Motor Company, New York City, that was recently put in service by the Kerckhoff-Cuzner Lumber Company. The truck was built especially to the order of the company and the length of the bed back of the seat measures 18 feet two inches. Twenty-six foot lumber is carried with ease.

The truck has been equipped with the Barnard carburetor and burns distillate. A novel loading device has been perfected by the company at the lumber yards. When a load is assembled it is hauled by wagons to a specially built crane which, when the load is complete, picks it up and places it on the waiting truck. The latter is idle only an average of five minutes while being loaded, which greatly increases the amount of work possible to complete with it in a day.

BRAKE AND SPRING CONSTRUCTION.

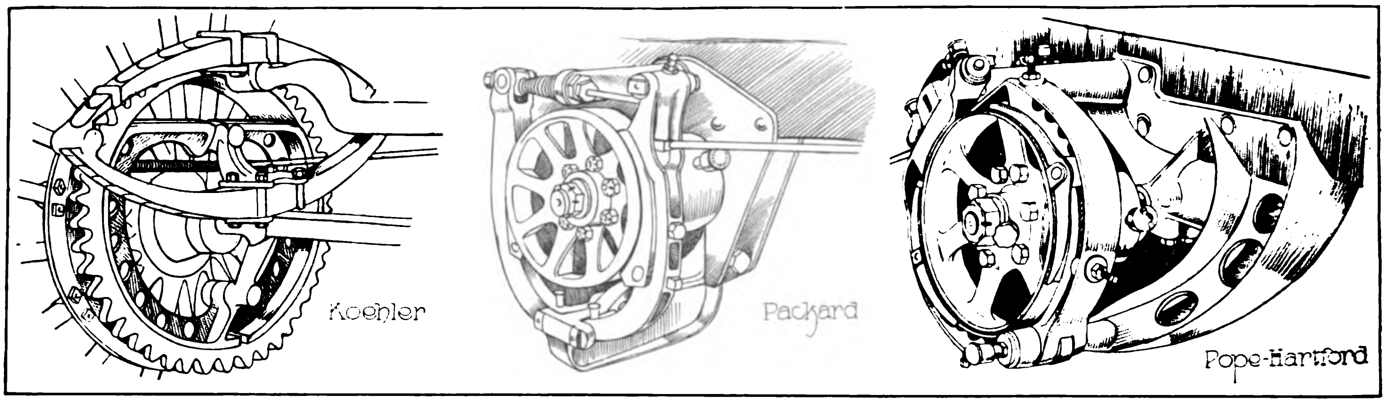
How Designers Have Perfected Control and Improved Suspension to Secure Greater Efficiency and Endurance of the Chassis.

EVEN casual examination of the chassis exhibited at the New York show demonstrated that a great deal of attention had been given by engineers and designers to the improvement of suspension and brakes, and that there is keen realization of the need of perfecting spring action and control. It can be accepted without question that the endurance, maintenance and economy of use of the machines is to a large extent dependent upon the springs and the manner of their utilization, and it is necessary for the protection of the vehicles and the property and lives of others that the control be such that when occasion may require they may be stopped in the shortest time and distance.

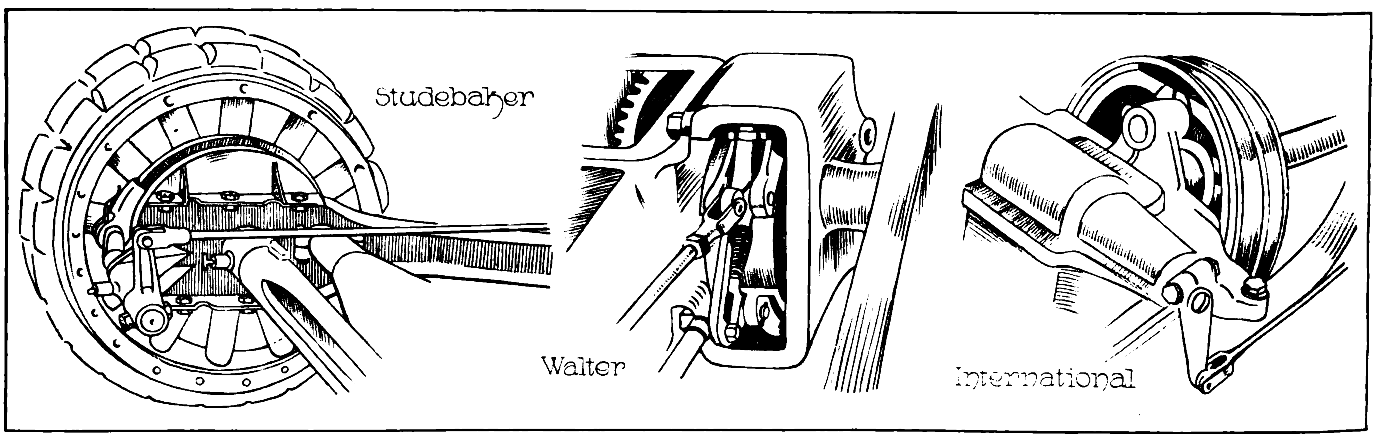
It is apparent that by compounding the brake linkage any pressure of shoes or bands may be obtained, but it is also certain that with the wear of the shoes or bands and the connections of the links a large measure of the efficiency may be lost. To prevent wear from abrasive substances brakes are often enclosed, and then the wear can only be judged from the movement of the levers and the effects when used. If not easy of access they are frequently neglected and efficiency will rapidly decrease. Brake band linings or shoe facings will wear and if this condition is known it may not be changed because of the work entailed. For these reasons the designers have devoted their attention to brakes that will be certain of operation, will be accessible when adjustment is needed, and will wear for a very long period without loss of efficiency.

Perhaps one of the most interesting features is the locomotive type, so-called, of brake developed for the Packard and Pope-Hartford machines, and is fitted to all these wagons of three or more tons capacity. In the Packard trucks the jackshaft hanger has been designed to carry the brake shoe shaft, the hanger being a heavy steel casting that has an extension at the lower part. This extension is supported by webs and it carries the large bolt which secures the shoes and on which they move. The shoes are webbed to secure lightness and strength and they are linked at the top by a rod on which is a spring. The brake rod is connected so that a direct forward pull is given and the shoes are drawn together, clamping a drum or pulley on the end of the jackshaft. This is the service brake and is used constantly. The construction gives a very large area of braking surface and while the metal shoes will wear slowly they can be adjusted quickly and can be renewed at slight expense when no longer serviceable.

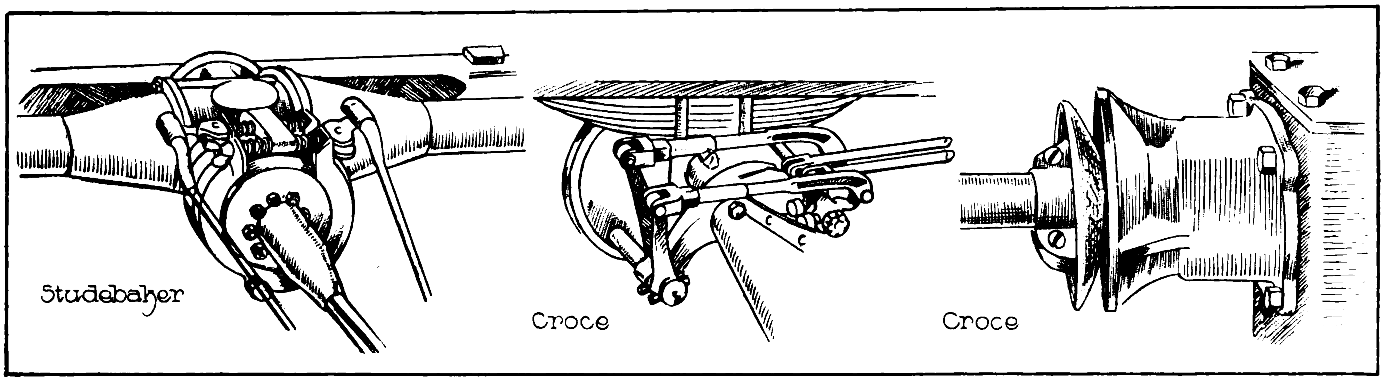
The Pope-Hartford service brake is designed with



Braking Power Greatly in Excess of Needs Afforded in the Light Koehler Wagon and the Packard and Pope-Hartford Truck.



Originality Evidenced by the V Shape Brake Shoe of the Studebaker, the Enclosed Band Brake of the Walter, and the Transmission Brake of the International.



The Double Driving Shaft Brake, a Feature with the Studebaker; the Compounded Linkage and the Clutch, Original with the Croce Machines.

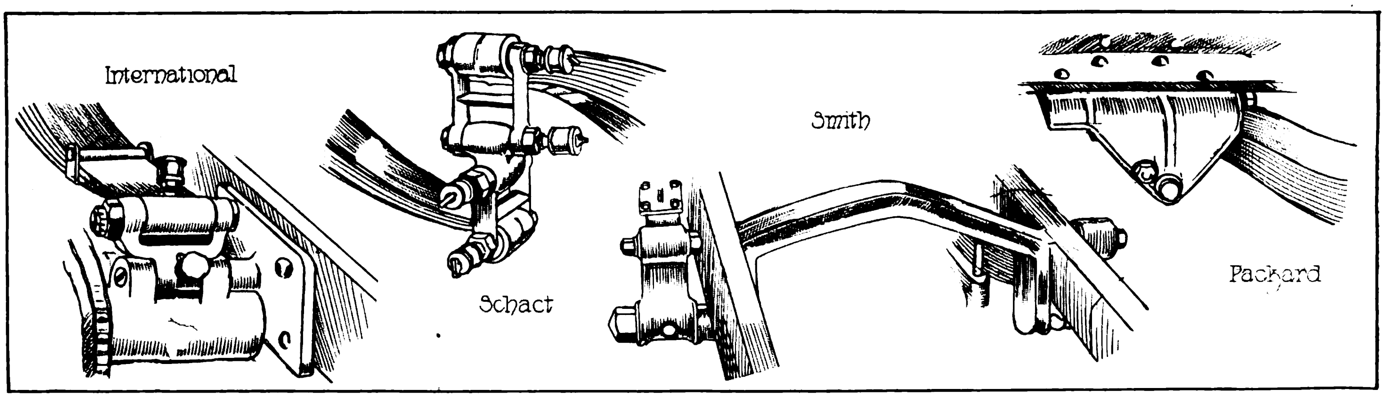
much the same idea, but it differs in the form of the jackshaft hanger extension, which is webbed and drilled to obtain strength and lightness, and the brake shoe is more of the constricting band, being carried on a bolt at the bottom and with the shoes separated by the conventional spring at the top. The shoes are clamped about the drum by the drag of the brake rod and, as with the Packard, they may be easily adjusted and renewed. With both the bolts on which the shoes swing are lubricated by grease cups.

In the Koehler wagon a very ingenious expanding brake is fitted to the rear wheels. The brake drum and sprocket is cast integral and the drum is bolted to the wheel spokes with clips. The spring saddle is a large steel casting that has two arms, the one projecting upward and the other downward, and so curved that they clear the wheel hub. In the ends of these arms are eyes, and a bolt through the lower forms the fulcrum for the brake shoes to swing on, while the other carries a shaft on which is a double cam, and with this cam is formed a lever. The upper ends of the brake shoes are normally drawn from contact with the drum by helical springs, but as the cam is turned it separates the shoes, forcing the shoes apart and against the walls of the drum. This brake has a very large shoe area and it is adjustable by changing the spring tension.

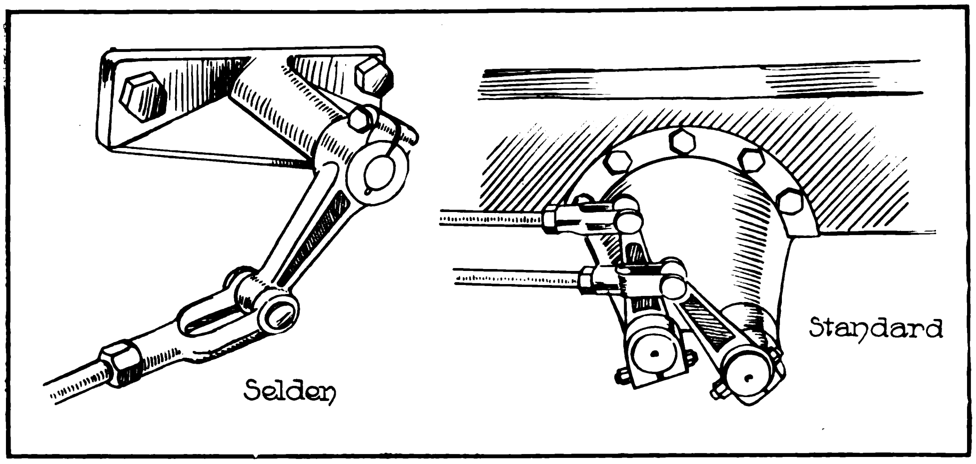
The second emergency brake of the new Studebaker gasoline truck—and it is understood that this design is to be used in the construction of all sizes of these machines—is a decidedly novel application and it is maintained that it is unusually efficient. The truck is driven by concentric gearing and on the periphery of the drum in which the internal gear is cut is a heavy ridge or tongue with sides bevelled so that the top of the tongue is about half the width of the base. The rear ends of the pressed steel radius rods project back of the axle and the lower side of this carries a fitting in which is a shaft, on which swings a long brake shoe in the face of which is a groove shaped as is the tongue, but of such width that the tongue will engage about half the depth of the groove. The shaft has an arm at the other end to which is linked the brake rod, which is carried above the axle. The movement of the emergency brake lever draws the long shoe forward and against the tongue on the drum and both sides of the groove engage. The metal surfaces are given a wedging contact and the braking area is considerable. The construction is such that the wear does not affect the efficiency and the tongue cannot bottom in the groove in the shoe, while adjustment may be quickly made.

A decidedly novel design is that of the service brake on the Walter trucks, where a single drum is mounted on the jackshaft and on this is a contracting band. The drum and band are both large to obtain efficiency and to protect these a casting is bolted to the left side of the combination transmission gearset and differential case, through which the jackshaft passes. The case is very heavy and at the rear is the shaft on which the shoes of the brake swing. As the case is open at front and rear the brake shoes may be easily reached and adjusted.

An unusual application is made in the design of the service brake of the new International delivery wagon in that it has expanding shoes that act on a



Spring Hangers and Shackles Show a Careful Attention to Endurance and Lubrication and Some Very Ingenious Developments.



An Admirable Single Brake Shaft Bracket Is That of the Selden, and the Standard Is Equally Good for a Double Brake Shaft Bracket.

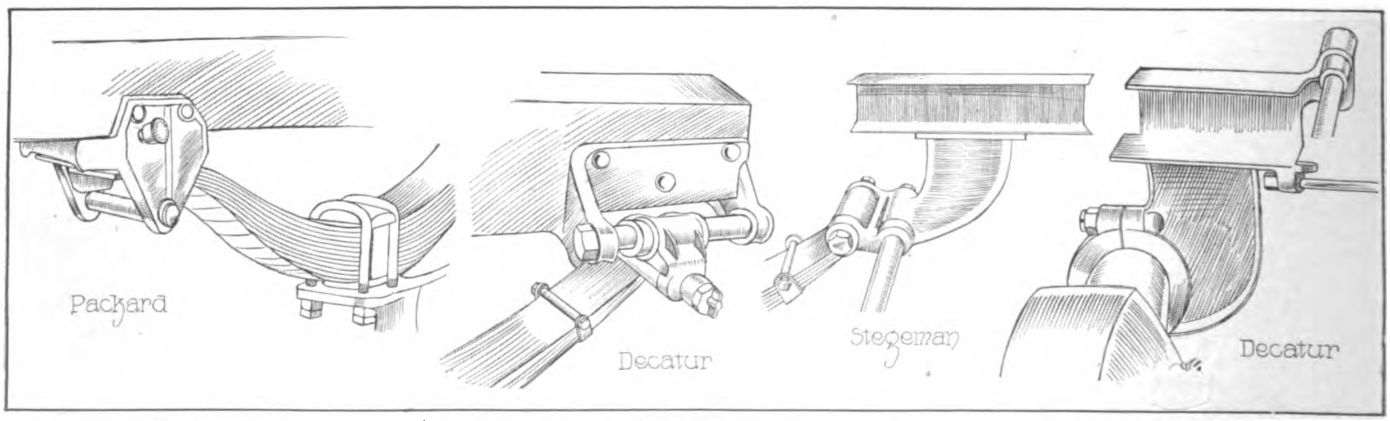
drum carried on the driving shaft, just back of the transmission gearset. The drum is of large size and the shoes have a wide face. On the gearset case is a fitting that carries a transverse shaft that has an arm projecting downward. This shaft is so connected that a forward pull turns a cam between the upper ends of the brake shoes and expands them against the drum.

The first emergency and service brakes of the Studebaker truck are a contracting type and are identical in construction. The two sections of the shoes are hinged at the bottom and the shoes are supported by rods extending through an arm carried forward over the drums, which are on the rear of the driving shaft. One end of the rods is threaded and at the other is an eye. The ends of the brake shoes form ears in which are holes, and the rods support the shoes by these ears, helical springs at either side of the supporting arm separating them. On the threaded ends of the rods are wing nuts by which adjustment is made. Fittings forming cams are pivoted at the eyes at the other ends of the rods, and into these the brake rods are threaded. The draw of the brake rods actuates the cams, drawing the shoes together and clamping the drum. The installation is so made that there is a brake rod at either side of the drive shaft.

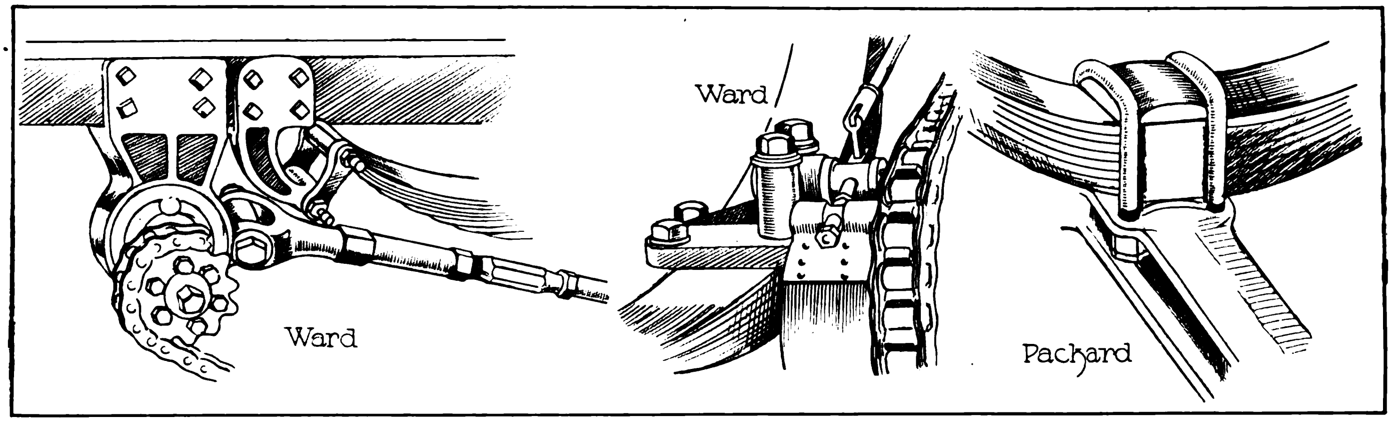
In the Croce wagons and trucks each end of the rear axle carries an arm that projects downward and carries a shaft and sleeve on which are mounted the lever arms to which are connected the rods operating the double set of internal expanding brake shoes. The lever arms are so arranged at either side of the supporting arm and the linkage is such that the braking strain is equalized over the connection. In the 1500-pound wagon a clutch brake of novel design is used. This consists of a conical member faced with asbestos clamped to the shaft that, as the clutch is disengaged, contacts with the faces of a recessed extension of a universal joint housing bolted to the forward side of the transmission gearset case. The joint housing is of bronze. The clutch brake is effective and noiseless, and adjustment may be made by loosening and tightening two screws in the shaft member.

Two interesting examples of brake shaft support are found in the Selden and the Standard machines. To secure straight movement of the brake rods it is necessary to extend the shafts beyond the side members of the chassis frames to such a distance that it is necessary to support them. The Selden design has a substantial member that encloses the shaft and webs strengthen it against any longitudinal stress. This is securely bolted with a long bearing against the frame. The Standard truck member is a semi-circular steel casting of cone shape that carries two brake shafts and it has a wide flange on which it is seated and bolted to the frame.

With springs an interesting shackle is that used on the new International wagon which has a very flat spring that has but little movement with deflection or reflexion. The spring is carried above the hanger and the shackle is a very short yoke, the neck of which is mounted in the hanger. In contrast to this is the double shackle of the Schacht platform suspension which gives practically a universal joint effect, and may yield to any movement, either longitudinally or transversely. The spring hanger of the Smith-Milwaukee truck is a heavy drop forged I section that serves as a frame cross member. This is shaped to give truss effect at the spring ends and it is bolted to the frame with the hangers below it. The shackles



How the Packard and the Decatur Designers Afford a Longitudinal Movement of the Spring Ends, and the Stegeman Engineer Provides Rigidity of the Hangers.



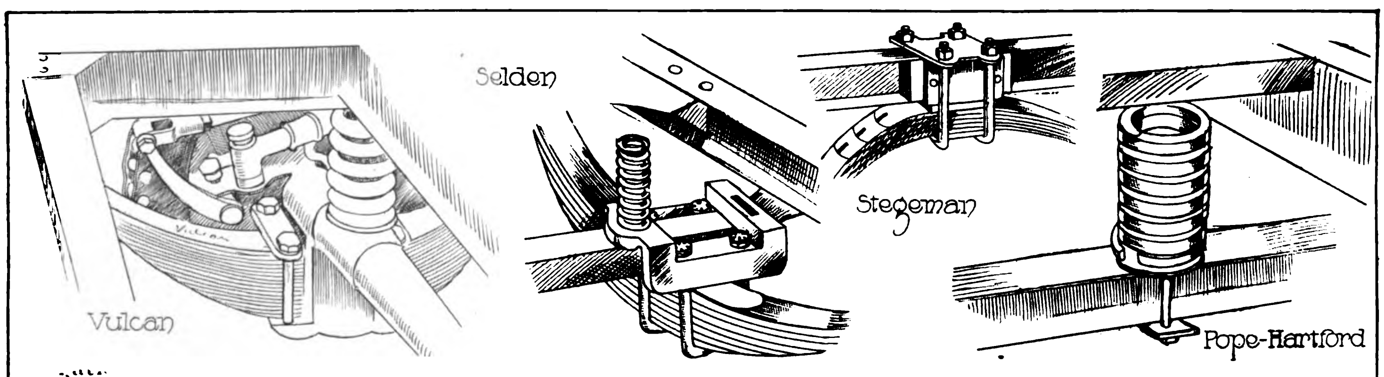
The Forward Radius Rod Connection and the Combination Spring Saddle and Brake Shoe Bracket of the Ward Electric; the New Spring Saddle and I Section Packard Back Axle.

are steel castings of large size and U shaped to insure the greatest strength. One end of the hanger is carried through the shackle end, and at the top a bolt couples the spring and hanger.

The Packard five-ton truck rear springs are mounted in fittings bolted to the frame so that the master leaves contact with the lower webs of the frames. These fittings are cast steel and when assembled the spring ends are free to slide in them as the springs are compressed or recoil. The inside and outside of the frame of this construction are illustrated. With the Decatur delivery wagon the same effect is obtained by mounting the yoke shaped spring shackle on a guide bolted to the outside of the frame, on which movement in either direction is free. The Stegeman design of spring shackle for the rear end of the rear springs is very short and instead of the usual bolt through the shackle and hanger a stout steel rod extends through both shackles and hangers and across the chassis, giving a greater rigidity to the spring hangers and stiffening the frame against varying spring action. In the same group that shows this construction is illustrated the jackshaft hanger of the Decatur delivery wagon, which is fitted to the shape of the chassis frame, and which also carries the support for the emergency brake shaft.

The jackshaft hanger of the Ward electric wagons and the spring hanger for the forward ends of the rear springs are very similar in design, being heavy steel castings bolted to the frame. The radius rod has a forward yoked end that is secured with a bolt to the spring hanger. This rod is adjusted with a turnbuckle fitting. In these machines a clever use is made of the rear spring saddles to carry the brake shoe shaft and the linkage for the brake rod, the saddles being heavily webbed and large bolts being used because of the unusual shape. The spring saddle of the Packard five-ton truck is made with sides that fit the spring its full depth and it has two transverse grooves at either ends into which the U shaped spring clips are fitted and drawn down by nuts below the spring seat, which is forged integral with the big I section axle.

The auxiliary springs of the seven-ton Vulcan truck are helical and are mounted in clamps secured to the big round rear axle. These contact with the frame at the juncture of a cross member when the weight of the load has sufficiently deflected the semi-elliptic springs. The auxiliary springs of the Selden delivery wagon are secured to the spring saddle, which is a drop forged member shaped to the axle with an opening above the axle the width of the spring. The spring clips are tightened by nuts that seat on the saddle at either side of the axle. The auxiliary springs engage with a heavy gusset plate when the side springs have been deflected. The Pope-Hartford auxiliary spring is helical, of square section, carried by a seat that is clamped to the rear axle, and this contacts with the frame when it has been partially loaded. With the Stegeman trucks the jack spring is supported by clips that are secured to a saddle carried on a frame cross member, and this cross member, of channel section, is stiffened under this saddle by a metal block that fills it and prevents buckling under a severe stress.



Auxiliary Springs, Both Helical and Curved, Show Some Interesting Developments for Very Light and Heavy Vehicles.

SIX CENTS A TON-MILE.

Packard Transportation Expert Gives Business Men of Pittsburg Interesting Cost Figures.

Hartley Howard, representative at Pittsburg, Penn., for the Packard Motor Car Company, Detroit, maker of Packard pleasure and commercial vehicles, recently delivered an address to the Manufacturers' and Contractors' Club of that city, in which he discussed the "Automobile vs. the Team." Mr. Howard said that he found but few contractors who could inform him of the cost a mile to deliver a ton of material.

In speaking of his own investigations, for the enlightenment of the business men present, he stated that it cost 12.5 cents a ton-mile to deliver goods by horse drawn vehicles, while with motor trucks it was reduced to 9.5 cents. He also stated that a three or five-ton truck could be operated for from $13.70 to $14 a day. The machine, if kept continually busy, will cover on an average of 40 miles a day, which, Mr. Howard said, would make the cost a ton-mile six cents.

KISSELKARS IN ST. PAUL.

Thirty of These Machines Replaced 145 Horses in Various Lines of Activity.

The Kissel Motor Car Company, Hartford, Wis., maker of KisselKar trucks, has collected some astonishing records of the service of KisselKar machines in various cities. An interesting case is the city of St. Paul, because of its hilly nature and the severity of its winters. In that city there are 30 KisselKar trucks in service, ranging in capacity from 1500 pounds to three tons, no four or five-ton vehicles having yet been sold there. These trucks replaced 145 delivery horses and they travel an aggregate daily mileage of 1566, making 3537 deliveries.

The most significant feature as well as the most gratifying from the standpoint of the truckman is the comparative average of initial investment. The trucks, including several specially designed, represent a total cost of $65,000. The horses replaced, including wagons, harness, blankets, etc., represented an outlay of $62,150. This slight difference in first cost, taken in connection with the ability of the motors to more than double their present mileage if worked a sufficient number of hours, is food for thought.

NEW CALIFORNIA TRUCK.

Holt Motor Company Secures Plant for Its Production in San Leandro.

The Holt Motor Company, San Leandro, Cal., has signified its intention of taking over the building of the Best Manufacturing Company of that place for the purpose of constructing motor trucks. The vehicle is said to be a new one on the market and the outlook for the concern is held to be promising.

The building will be entirely remodelled and expensive machinery will be installed. As soon as the plant is put in suitable condition for manufacturing operations will be begun. H. E. Dorman is to superintend the construction of the trucks. The business offices of the company will be in charge of W. J. Peters.

TWIN CITY CUSTOM MADE.

New Concern in Minneapolis Studies Needs of the Purchaser and Builds Accordingly.

The Brasie Motor Truck Company, Minneapolis, Minn., is a new truck concern recently organized in that city by Frank R. Brasie, who, in addition to being the designer of the vehicle, called the Twin City truck, is owner of the plant and its superintendent. A particular advantage to the purchaser is held to be in the fact that Mr. Brasie makes a personal inspection of each truck in process of construction.

The Twin City truck is not a factory outgrowth, but is built according to the user's needs. The requirements are first learned when an order is received and the vehicle is then constructed. A number of cars produced by the Brasie firm are in service in the Northwest. The factory is located at 2743 Lyndale avenue, South Minneapolis.

STEWART WIDELY DISTRIBUTED.

Used as Far North as Medicine Hat, Alberta, and as Far South as Buenos Aires.

Stewart motor trucks, made by the Stewart Motor Corporation, Buffalo, N. Y., now cover 100 degrees of latitude around the earth, according to figures given out at the Stewart factory. The vehicles are used as far north as Edmonton, Alberta Province, Canada, and the Medicine Hat garage at Medicine Hat, Alberta, has taken the agency. At the other end of the American continent, Pratt & Co., Buenos Aires, is handling Stewart trucks for Argentine Republic.

The first shipment to South America was made recently. Several of the trucks are being operated in Edmonton and a large shipment has been made to Medicine Hat. Stewart trucks are now running in 25 cities.

The Animal Rescue League of Pittsburg, Penn., which some time ago put into operation an automobile dog ambulance of two tons capacity, made by the Lange Motor Truck Company of that city, has given an order for a second Lange machine of the same design. The machine is divided into 34 compartments, thus preventing diseased and healthy anim——ming in contact with each other.

EFFICIENCY OF TRUCKS AS TRACTORS.

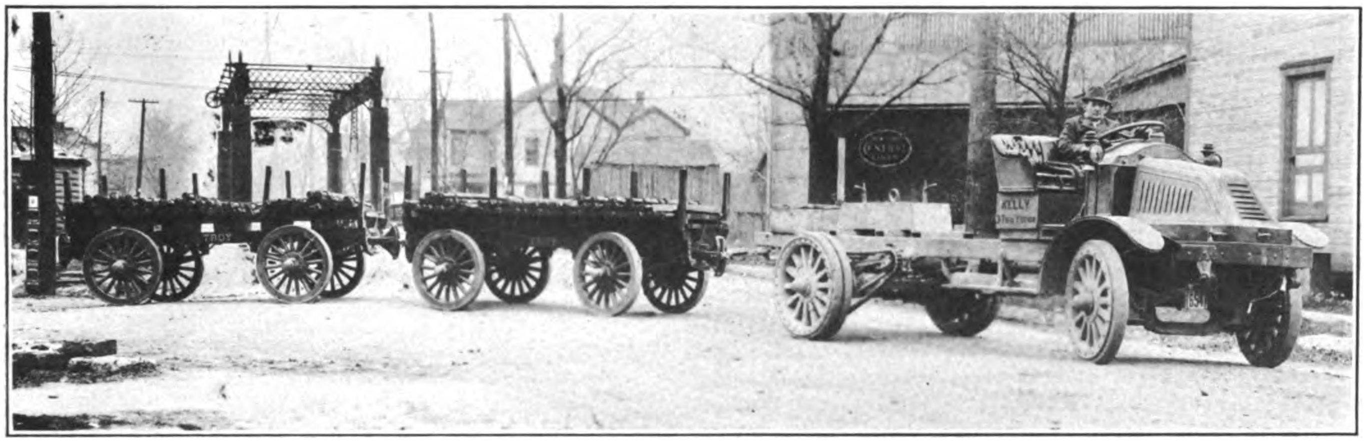
Tests Made by Troy Wagon Works and Kelly-Springfield Motor Truck Companies Indicate Possibilities for Some Services of Well Designed Trailer Trains.

WHILE tractors are an important factor in highway haulage abroad, especially in England, little attention has been given to their use in America. Comparatively few of the English machines are propelled by gasoline engines, for coal, coke, crude oil and similar cheap fuels are used for generating steam, which is the principal power, although several manufacturers install kerosene motors. The greater part of the heavy haulage, that is, loads ranging from five to 10 tons, is with steam trucks or lorries, which are often adapted to draw a trailer, and the traction engines, so-called, are machines which carry no load but have power sufficient to haul several trailers with loads weighing up to 20 tons.

The experience with tractors and traction engines has extended over a considerable length of time, and tests are frequently made which result in careful determinations of efficiency, but these are generally comparisons of similar vehicles and service and have not been, so far as known, with reference to all forms of vehicles. In England upwards of 7000 tractors and traction engines are in use, and the number is constantly increasing, it being generally the experience that the economy is material.

Attention has recently been directed by several American truck and vehicle makers toward the utility of tractors, and some have made very thorough development experiments with a view of ascertaining endurance and perfecting construction. Capacity appears to have been very satisfactorily determined, but comparative economy is little known. The Troy Wagon Works Company, Troy, O., has developed a tractor, which will probably be built in several sizes, and to determine the relative costs of the operation of reversible dump wagons of three yards rated capacity handled in trains and 1.5 yards team dump wagons, an investigation was made by Richard Turner Dana, a member of the American Society of Civil Engineers, director of the Construction Service Company, New York City, at the request of the company.

In this work four road construction contracts of various operations and conditions were studied and curves were plotted showing the haulage costs a ton, in cents up to 3.5 miles. This result is shown in Fig. 1, and considering this it will be noted that large saving is made by the train (indicated by the solid line), as compared with the horse wagons (indicated by the dotted line), in the longer hauls, as, for instance, assuming that a haulage of crushed stone in a six-wagon train (or 40,000 pounds a load) and in a two-horse bottom dump wagon (or 4000 pounds) for two miles, indicate a cost of 20 cents a ton and 46.5 cents a ton respectively. It will be noted, however, that the curves cross at about 1500 feet, beyond which point the economy of the train is apparent. The reason that the curves cross is in the proportion of the lost time to the actual time of hauling. All measures of efficiency are based on delivery, delivery being directly proportional to a combination of the average speed and capacity of the conveyance, and the average speed depending upon the proportion of lost time to the actual time of hauling.

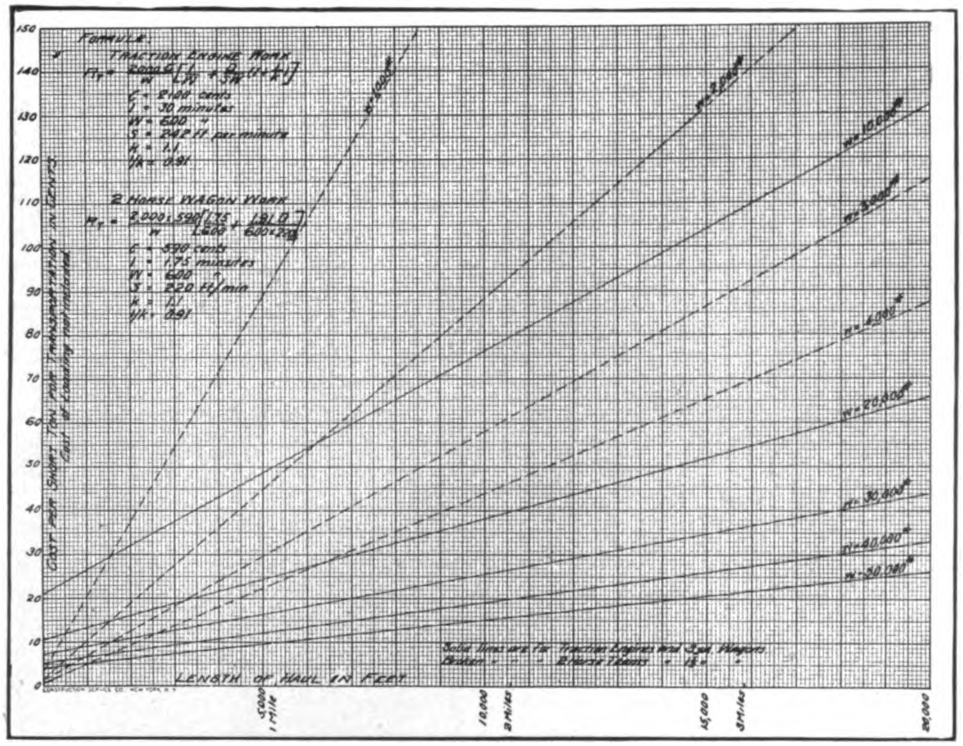


Kelly-Springfield Three-Ton Truck and Trailers Used in Efficiency Tests at Troy, O., for the Troy Wagon Works Company.

Mr. Dana's conclusions were based on very careful observations and well based formulae. The estimates of cost of different vehicles are: One team hauling one slat wagon, $5.8155; one team hauling two rear dump wagons, one of which is loading and one constantly in transit, $6.1025; three-ton motor truck delivering its rated capacity, $8.0866 (total a mile loaded, $0.1537); motor truck serving as a tractor and three trailers, one of which is loading, one unloading and one in transit, $10.7366 (total a mile loaded, $0.2189); motor truck serving solely as a tractor and six trailers, of which two are loading, two unloading and two in transit, $27.8866, including $12 extra labor loading and unloading (total $0.3602 a mile loaded,

and it is pointed out that a satisfactory trailer must stand the stress of higher speeds, with plain, stout, well-lubricated bearings, that will track perfectly with the motor on curves, that is reversible, that can be pushed or drawn at will, and small enough that it can be used easily in trains, so that by its ease in handling the lost time will be reduced to a minimum.

To learn the utility of motor trucks with trailers the Troy Wagon Works Company, in conjunction with the Kelly Motor Truck Company, Springfield, O., made 16 experiments with a Kelly-Springfield three-ton truck and Troy trailers, 10 of these being on city streets preliminary to making others of more definite character. The truck was rated at 35 horsepower, had four speed ratios and a maximum speed of 12 miles an hour. It carried 5000 pounds weight during the tests and with this load weighed 10,200 pounds. One, two and three trailers were used, each weighing approximately 2000 pounds and having a carrying capacity of five tons. During a part of the test the trailers carried four tons, but were later tested fully loaded.

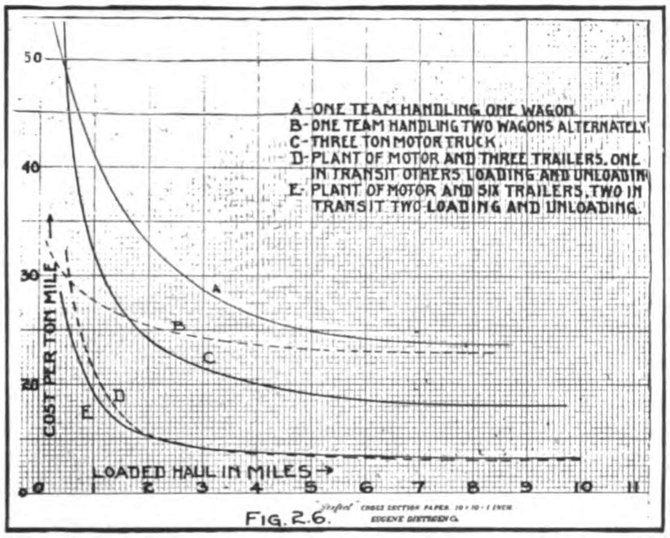


Cost a Ton for Traction Engine Trains and for Animal Vehicles.

The observation was carefully made. The drawbar drafts were recorded every tenth revolution of the trailer wheels, these being read from a Kohlbusch dynamometer mounted in the frame between the truck and the trailers. Time was kept by a stop watch and was recorded at every station from which velocity was determined. The grades of the routes were official. During the test the three trailers were loaded ...th four tons and forward drawbars, locked, rear draw- free, and one man steering the trailer. The train ...ked 400 feet and around a 90-degree cor- ...rated that while it was flexible enough ...l it was rigid enough to resist buckling. This test was made on brick paving and again on macadam with the trailers carrying five tons. For the final experiments a seven-mile course was surveyed, one mile of which was on brick paving and five miles on country macadam road. Marks were well defined for timing, locating the grades, and the different kinds of road. In these final experiments a Kelly-Springfield three-ton truck of 40 horsepower was used, having three speed ratios and a maximum speed of 12 miles an hour. The same dynamometer was used.

Six tests were made as follows: Motor truck and one trailer loaded with five tons of steel; motor truck and two trailers, each loaded with five tons of steel; motor truck and two trailers, each loaded with 2.5 tons; motor truck and two trailers, driven at the same approximate speed as the test when half loaded. Six observers and recorders were carried on the train. The observations noted were the stations, dynamometer, total time, the gear ratio in use and the landmark number, and the reductions included the distance, actual drawbar pull, time interval, velocity and elevation. From these data the reductions were made and the curves plotted, showing the actual drawbar draft, the speed ratios used and the different velocities for the entire route. The motor truck loads were cast iron blocks weighing 2250 pounds each, and on the trailers steel axles weighing 122 pounds each. The live loads included the blocks, axles and men riding, but the driver was regarded a part of the dead weight of the truck. The motor truck dead load was 7980 pounds and the trailers weighed 2080 pounds each.

The first run was of the truck with its rated capacity. The second was with a five-ton load concentrated on a single trailer. The third was to test the maximum draft and tractive capacity of the truck, and on this the motor was stalled four times. The fourth run was with a five-ton load uniformly distributed on the trailers, a comparison of the second run. The fifth run was to test the efficiency of the trailers, but the live load on the truck was reduced from 2.6 to 1.4 tons to observe to what extent the live load of the fourth run caused the stalling of the motor, and the effect of the reduction of the load on the tractive capacity of the truck. There was no loss of traction and the motor climbed one of the hills on which it was stalled. It was concluded that the truck could have been materially lightened and still have capacity to maintain a sustained pull of more than 3000 pounds, and to draw



Relative Cost of Motor Truck and Trains of Trailers.

a dead and live load of 14 tons on good roads and on grades up to 14 per cent. The sixth run with empty trailers was for comparison and the velocity was kept to approximately that of the fifth run. It was concluded that the advisability of small units in trailer trains was demonstrated, for where a train is stalled the lost time may be minimized by breaking up the train and moving the trailers singly over the obstructing grade.

The total load handled and the quantity of gasoline consumed during each run were as follows: First, 7.6 tons, 1.9 gallons; second, 13.7 tons, 1.9 gallons; third, 20.5 tons, 6.1 gallons; fourth, 16.1 tons, 2.2 gallons; fifth, 19.5 tons, five gallons; sixth, 9.7 tons, 4.5 gallons. There is uncertainty as to the fuel consumption for the sixth run. The carburetor of the truck was new and was receiving its first trial, and to this and, possibly, to careless driving, the wide variance may be due. The six runs covered about 42 miles. The result of the tests demonstrated that a three-ton motor truck will maintain a sustained draft of more than 3000 pounds and that on ordinary paving and at average speeds and normal grades the draft required by one trailer with a five-ton load ranged from 400 to 2000 pounds, and from 750 to 3000 pounds for two trailers loaded with five tons each, the variance averaging from 50 to 200 pounds a ton.

The estimates of cost of different vehicles, which have been stated, are applied to the accompanying tabulation.

The accompanying chart demonstrates the facts specified in the above tabulations and indicates the efficiency of the single and two-wagon outfits, the truck alone and used with trailers under different conditions.

Considering these facts, however, it will be noted that the conclusions are based on a series of tests that at best can be regarded nothing more than preliminary. It is stated that there will be a variance in the cost of animal haulage according to the locality conditions, but this is quite as true of the motor trucks and the trailers.

As a matter of fact the expense of using animal teams and wagons is set very low and it is exceedingly probable that it would be materially increased in experience. For instance, in the estimates the horses and driver are hired at $5 a day, but it is evidently assumed that the person doing the work owns the wagons and the harness, for these are separated from the item of horse hire and driver's wages. Depreciation on the wagons and liability insurance (the latter being an item that is not generally carried by horse vehicle owners) and an item of interest are also specified. The estimate evidently comprehends ownership of the motor truck and the trailers.

There is no doubt that a contractor will hire horses and carts, but it is customary to have the price include every charge and the wages of a driver, and this one price covers everything save the matter of tools and superintendence, but only the latter item can be apportioned.

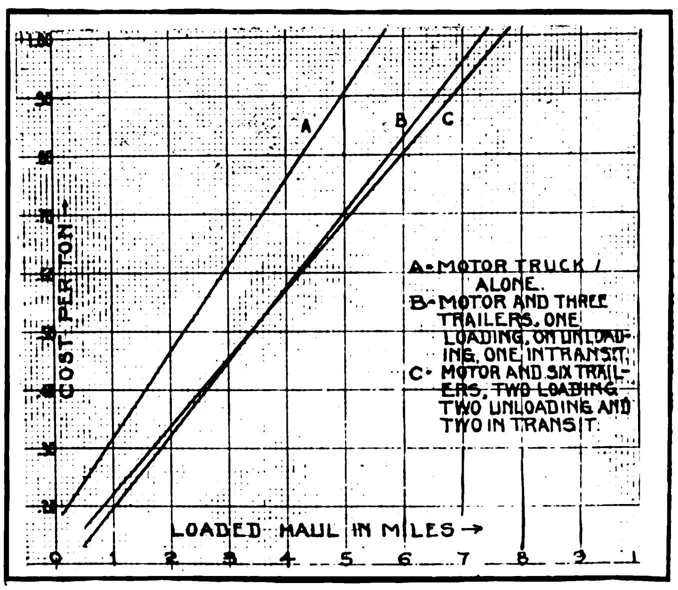
As to the motor truck, it would seem probable that a five-ton machine would be considered rather than one of lesser capacity, because volume of cartage

Tons Delivered, a Day.

Length of Haul	One Team One Wagon	One-Team Two Wagon	Truck Only	Truck and Three Trailers	Truck and Six Trailers
.5 mile	24	42	33	110	210
1 mile	15	23	30	100	180
2 miles	9	13	24	80	150
3 miles	6	10	21	70	110
4 miles	6	6.5	18	45	90
5 miles	3	3.3	13	35	70

Cost a Ton-Mile.

Distance of Loaded Haul in Miles.	One Team, One Wagon, Cost a Ton-Mile.	One Team, Two Wagons, Cost a Ton-Mile.	Motor Alone, Cost a Ton-Mile.	Motor and Three Trailers, Cost a Ton-Mile.	Motor and Six Trailers, Cost a Ton-Mile.
½	0.444	0.258	0.480	0.210	0.258
1	0.319	0.222	0.319	0.154	0.167
2	0.256	0.205	0.240	0.143	0.118
4	0.221	0.196	0.200	0.137	0.106
6	0.214	0.194	0.186	0.135	0.104
8	0.209	0.192	0.179	0.134	0.103
10	....	....	0.176	0.134	0.103



Ton-Mile Cost of Motor Truck and Trains of Trailers.

means an economy, and the difference in cost of operation is comparatively small. Not only this, but the large truck would be much more serviceable with a train of trailers and it would have more speed than would be desirable in loaded train haulage.

The use of the motor truck that will haul two loaded trailers does not in any way establish the value of the traction engine that will haul six trailers, for instance, for while the truck may be faster it is limited in its capacity, and the traction engine will haul twice the number of tons at a speed of four miles an hour, to illustrate. Not only this, the character of the work, the location, the size of the contract, all are important factors, and it is not possible to apply with any degree of accuracy an arbitrary price. As a matter of fact the cost of the work will vary decidedly, and where the construction is to continue for a considerable period the weather conditions must be considered.

There are specific uses for the tractor or traction engine, just as there are for the motor truck, but these must have weight and power rather than speed, and must be adapted for use on rough ground. If they are to afford service as in England then the machines and the trailers must be easy of handling in traffic and be more adapted for highway haulage than for service on soft and rough ground. It is evident enough that the machine designed for construction work must be of a different type than that built for road transportation, and obviously the efficiency of either would differ according to the work done.

There are many factors to be considered in transportation, and it is evident that to assume a constant for any one of these would be decidedly misleading. It is certain enough that the same factors could be used but each might and probably would have a different value. This application may be made with reference to animals, motor trucks or tractors.

The utility of the tractor and the traction engine is a subject in which there is undoubtedly increasing interest, and the opinions of those who have given the subject study and consideration are of decided importance. These conclusions may be based on facts obtained in this country or abroad, but they are worthy of the attention of all, because they will have a definite value in establishing at least a basis for operation data.

KISSELKARS ON FRUIT FARMS.

California Owners Increase Revenue $20 a Day by Utilizing Motor Vehicles.

Motor vehicles are rapidly being pressed into service in the fruit belts of California and the results have been very apparent to the fruit growers. One example is that of Orlando Moore of Visalia, Cal., who uses a three-ton KisselKar truck, for not only hauling his fruit to market, but for plowing and pulling up tree stumps about the farm. Fruit crops have been prolific in California and owing to the difficulty of getting them to market a large percentage remained on the ground and were lost. These are now saved by the quick delivering motor trucks.

Another man who utilizes a KisselKar truck is F. H. Cavanaugh of Simmler, Cal., which is 28 miles from the nearest railroad station. He formerly hauled his fruit with mules and it required 10 of them three days to make the journey. The trip is now made by the KisselKar in half a day and sometimes two trips are made in a single day. The change has increased Mr. Cavanaugh's revenue from $50 to $70 a day. Some of the little known places in California where motor trucks have been put in service by the fruit growers are Pleasanton, Livermore, Martinez, Le Mesa, San Dimas, Poway and Escondido.

TO PROTECT CREDITORS.

Cleveland-Galion Motor Truck Company Placed in Hands of a Receiver.

Judge Pearson of the common pleas court at Cleveland, O., appointed A. B. Thompson as receiver for the Cleveland-Galion Motor Truck Company, which manufactures the Cleveland-Galion truck. The petition was brought primarily as a measure of protection against hostile interests, it was said.

Elliott Bright, a creditor to the extent of $350, alleged that suits which were about to be filed by other creditors might endanger the stability of the company. President H. W. Woodward of the company concurred in Bright's petition. The offices of the concern are at Cleveland and the plant is located at Galion.

DOG CATCHER USES FEDERAL.

San Francisco Society Employs Wagon to Displace Four Horses at Decided Saving.

In San Francisco, Cal., the Society for the Prevention of Cruelty to Animals has provided for the taking of muzzleless dogs to the public pound. A Federal chassis, made by the Federal Motor Truck Company, Detroit, equipped with a spacious body suitable for carrying the dogs operates daily through the streets of the city. This truck carried three men and the body of the vehicle has 10 divisions to keep the dogs separate.

The machine displaces a wagon with which were employed four horses because of the hilly nature of the streets, two being formerly used in the forenoons and two in the afternoons. The reduction in expense has been a great saving to the society and more than offsets the depreciation in the truck. The latter has been in service six months, covering a total of 6084 miles, or an average of 1000 miles a month at an average cost of $1 a day. It is stated that no mechanical trouble of any kind has been encountered.

THE A B C OF MOTOR TRUCK IGNITION.

Part VII—Outlining the Various Systems Utilized with the Commercial Gasoline Vehicle Their Components and Application in Practise—How Synchronization of the Spark is Secured—Outlining Construction and Operation of the Distributor.

By C. P. Shattuck.

SYNCHRONIZATION of the spark, especially with multi-cylinder motors, makes for greater efficiency in that the time of the explosions and subsequent impulses to the crankshaft are divided evenly, a condition making for a smooth running motor and tending to reduce vibration. By synchronism is meant that the mixture of each cylinder of the multiple unit is not ignited earlier or later than the predetermined instant. The advantage of controlling the time of ignition is obvious. It has been pointed out that theoretically the spark is supposed to occur when the piston has completed its compression stroke and has begun its downward movement or power impulse.

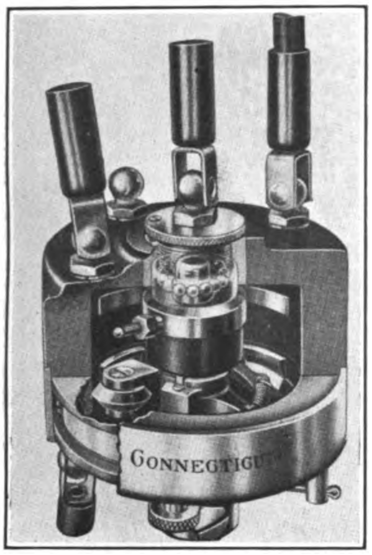


Fig. 29—Showing Components of Connecticut Distributor.

Assume that the point of ignition is top dead centre and that the spark occurs in the first cylinder when the piston is in that position: Expansion of the gases follows and maximum energy is imparted to the crankshaft. If the ignition of the mixture were to take place when the piston had completed part of its downward stroke it is obvious that the impulse would not be as great as if it had taken place at the proper time. This is demonstrated by starting a motor with the spark retarded, then advancing it, when it will be noted that the speed of the motor increases and with the throttle opening unchanged.

To further illustrate the result of irregular time of ignition let it be assumed that the charge in the first cylinder is exploded with the piston at dead centre, the second with the piston an inch down on the firing stroke and the next to fire slightly before dead centre. The results are: A variance in the time of igniting the mixture, more or less efficiency from the expansion of the gases, irregular impulses and the motor subjected to undesirable stresses. Maximum efficiency is not secured from the fuel in that part of the charge passes out with the exhaust without having been converted into useful energy.

Lag in Coils.

It will be seen that it is important that the spark should occur at the proper instant. With the multiple-unit induction coil it is not possible to obtain perfect synchronization of the spark; that is, it does not occur in practise because of a number of existing conditions which will be considered. It has been explained that each unit of the coil acts independently of the others; that the primary circuit is interrupted by a vibrator which comprises a thin strip of metal, and that it remakes the connection between the platinum contact points when the core member loses its magnetism. The time taken by the vibrator member to return to its normal position or contact depends upon its tension, which is adjustable by means of the knurled screw member carrying the fixed platinum contact point, and the flexibility of the metal itself.

Effect of Adjustment.

If the tension of one unit be adjusted to be more or less flexible than another, and if all four differ, it follows that there will be a variation in the time of breaking the primary circuit as well as that of inducing or transforming the current into high-tension. Similarly, the spark in one cylinder will occur earlier than that in another. While it is admitted that the manufacturer of coils synchronizes them and that they reach the user in proper condition, in time the operator will change the adjustment according to the condition of the batteries. Another factor to be considered is the pitting or fusing of the points, a condition that makes for greater resistance. The adjustment of coils requires experience and the various methods and care of the units will be taken up in logical sequence.

Function of Distributor.

Synchronism can be obtained in several ways, either by the use of a master vibrator and a multiple-unit coil, or by a distributor. As the name implies, the distributor distributes the secondary current to each cylinder in proper order. Its principle of operation is similar to that of the timer or commutator in that it is provided with a number of segments, con-

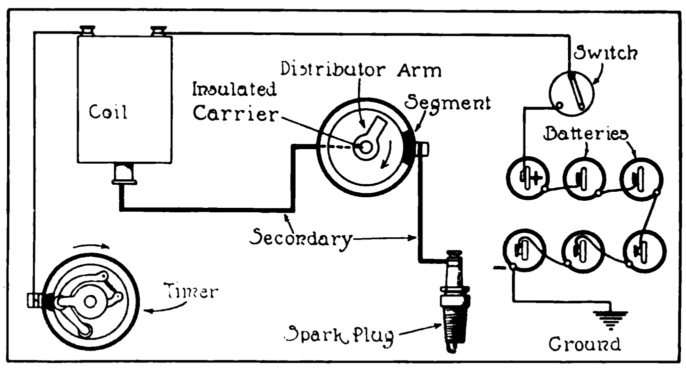


Fig. 30—Illustrating Wiring Plan of Distributor with Primary Section Separated to Outline Circuits.

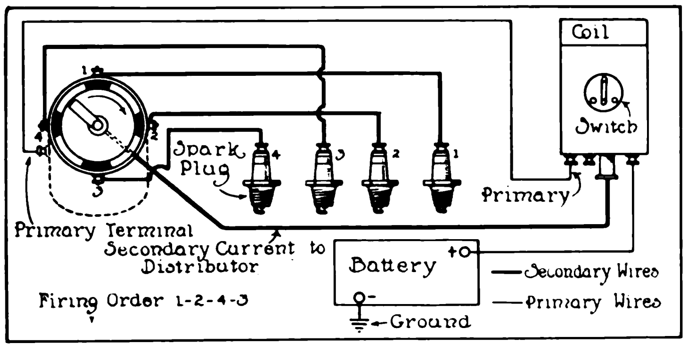


Fig. 31—Wiring Diagram of Four-Cylinder Distributor with Motor Firing, 1, 2, 4, 3.

tact with which is made by a distributor arm, the number of segments equalling that of the cylinders. The distributor may be compared to a double timer, the one caring for the primary current, the other the secondary or high-tension.

Construction of Distributor..

Distributors vary in design, but their principles of operation are similar. At Fig. 29 is presented a conventional type with a section cut away to show the components, and it will be noted that it is composed of two principal parts, the primary and secondary, which are held together by two threaded studs having spring tension lock nuts, a construction making easy disassembly or cleaning. The primary section is similar to the ordinary timer and the unit illustrated is utilized with a four-cylinder motor.

The timer and distributor sections are separated by a hard fibre disc, this being employed to prevent lubricant working from the timer into the distributor and thereby creating trouble. The upper section is composed of a fine grade of hard rubber, accurately machined and polished, and the walls are substantial to prevent warping or distortion when exposed to high temperatures. The construction is dust and water proof.

Mounted upon the shaft extending from the timer section is a key retained hard rubber cap to which is secured and from which extends the metal distributor arm insulated from the metal shaft, but in contact with a stud or terminal member. On the inside of the rubber case and in line with the distributor arm are mounted slightly projecting contact blocks spaced in synchronism with the contact maker in the lower section, and secured in a manner similar to the contact blocks of the timer.

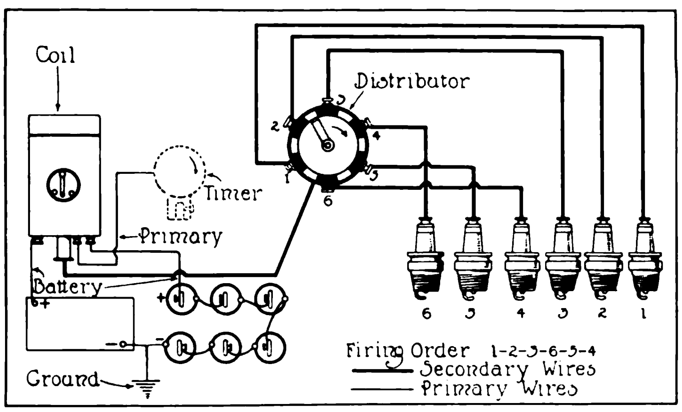


Fig. 32—Six-Cylinder Wiring Plan—Primary Section of Distributor Is Indicated by Dotted Lines.

Operation of Distributor.

The distributor replaces the usual timer and is mounted upon a shaft which rotates at camshaft speed. Its operation is as follows: The primary current is led from the storage battery, dry cells or other source in the same manner as with the ordinary timer; that is, one wire is grounded and the second is led through the switch, thence to the primary connection of the coil. When the roller makes contact with the block in the timer section of the distributor, the circuit is closed and the low-tension current is transformed into high by the coil. It passes from the coil through the secondary wire or cable to the insulated distributor arm in the distributor section and when this arm comes opposite the metallic plate or segment, the high-tension current jumps across to the segment, passing out through the insulated terminal, thence proceeding to the spark plug by the conventional lead.

The circuits and components are depicted at Fig. 30, the timer and distributor members being drawn separately to make clear the flow of the primary current, its interruption and the method by which the high-tension electricity is led to the distributor arm. The wiring plan is that utilized with a single-cylinder motor, but the high-tension current may be distributed to any number of cylinders, the construction involving a segment for each.

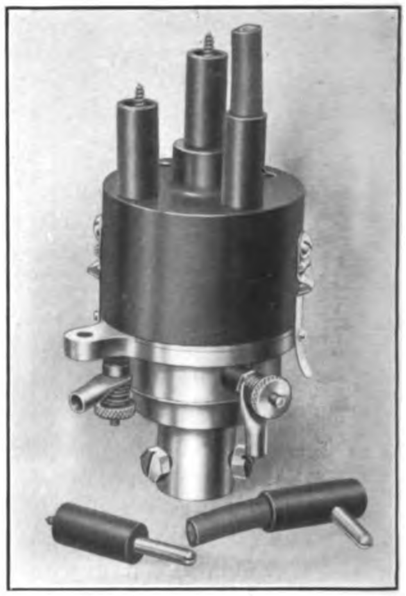


Fig. 33—Connecticut Igniter Distributor.

Requirements of Design.

The requirements of design are such that the primary and secondary sections of the distributor must be separated in such manner that lubricant cannot find its way into the high-tension compartment, for it is well known that particles of metal or carbon mixed with oil form an excellent conductor of electricity. It is also imperative that other foreign matter be eliminated. The distributor proper does not need lubrication as there is no friction except at the shaft bearings and these are contained within the primary section. The distributor arm does not make contact with the metal segments as it does in the primary section or a timer, there being a very small space between the end of the arm and metal segments. This creates a gap which is held to be beneficial.

The advantages of a distributor are: Synchronization of time of spark, compactness and the elimination

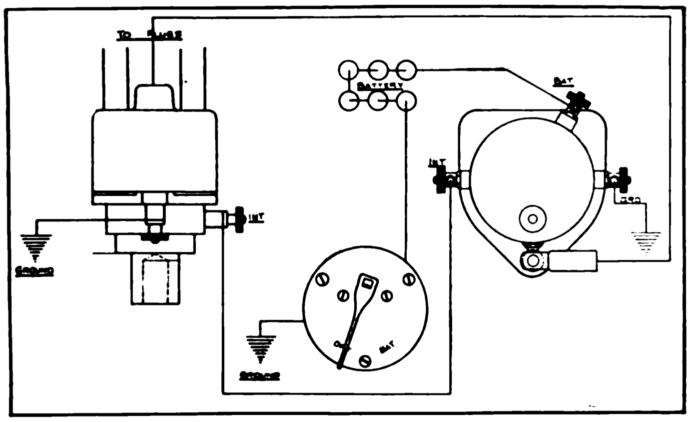


Fig. 34—Wiring Plan of Connecticut Igniter Distributor and Coil System.

of multiple coils and wires when utilized with a power plant of two or more cylinders. But one induction coil is necessary, and with a vibrating unit employed the alteration of the tension of the vibrator member does not affect the time of the spark when multiple cylinders are involved. Even with the platinum contact points pitted the resistance is the same, irrespective of the cylinder to be fired. Lag is eliminated in that when the motor is running at high speed the vibrator is practically in constant motion and this increases motor speed as there is no time lost after energizing the primary coil by setting in motion the vibrator. In place of the four or six primary timer leads, but one is employed, this conveying the primary current.

Four-Unit Distributor.

At Fig. 31 is shown the wiring plan of four-cylinder distributor and with the motor firing 1, 2, 4, 3. The method of the distributor is practically the same as with the ordinary timer, the piston of the first cylinder being brought to the top of its compression stroke and allowed to descend slightly on the firing, with the distributor arm opposite a segment, the No. 1 for example. Provision is made for securing the distributor to the shaft and locking it as with the usual commutator.

The wiring is simple. One lead of the battery is grounded to the frame or other metal part of the chassis and the positive wire secured to the "battery" terminal on the coil. From the coil is led a primary wire to the primary terminal on the lower section of the distributor, this being denoted in the drawing by dotted lines.

The one secondary wire from the coil is then secured to the terminal or post on top of the distributor. With the shaft rotating clockwise, the high-tension cables from the high-tension terminals on the distributor are connected to the spark plugs in the same manner as with a four-unit coil; that is, the first and second segments are wired to the first and second cylinders while the third and fourth terminals are connected to the fourth and third cylinders respectively. If the driving shaft rotates anti-clockwise, the leads will have to be reversed and the connections made according to the order of firing of the motor, which may be 1, 3, 4, 2 instead of 1, 2, 4, 3. A little study of the wiring diagram should enable the reader to wire the distributor properly.

At Fig. 32 is shown the wiring plan for a six-cylinder distributor and it will be seen that there are six segments, one for each unit. In this instance there are two independent sources of current, a set of dry cells and a storage battery, but both are grounded by splicing the negative lead of both batteries and securing the wire to a metal part of the chassis. The positive wire from the dry cells is secured to the right hand battery terminal on the coil and the lead from the storage carried to the other post on the coil.

As in Fig. 31 the primary section of the distributor is indicated by dotted lines and the primary wire is connected to this member. The firing order of the power plant in this instance is 1, 2, 3, 6, 5, 4, and the connections between the segments and the spark plugs are made in this order. As previously pointed out, any number of segments may be utilized, depending upon the number of cylinders.

Igniter Distributor.

Synchronization of the spark may be obtained by a master vibrator or by an igniter distributor. With the latter system the igniter member is operated from the camshaft. With four-cycle motors it is driven at one-half engine speed and at crankshaft speed with two-cycle engines. Like the distributor previously described it must be actuated by a gear driven shaft. It is provided with a primary circuit breaker mechanism, making for synchronism, and the device is fitted with cams which actuate the circuit breaker and strike the roller of the breaker arm, thus making and breaking the primary circuit successively. The breaker mechanism consists of a light steel lever pivoted on a steel stud, a bone fibre roller bearing against the cams, and a platinum contact held against a platinum tipped contact screw by a steel spring. The screw member is insulated and is accessible for adjustment, cleaning, etc.

The distributor arm is secured to the shaft and carbon brushes are employed to make contacts with the distributor blocks and secondary coil terminal. The operation of this member in distributing the high-tension current is similar to the system previously de-

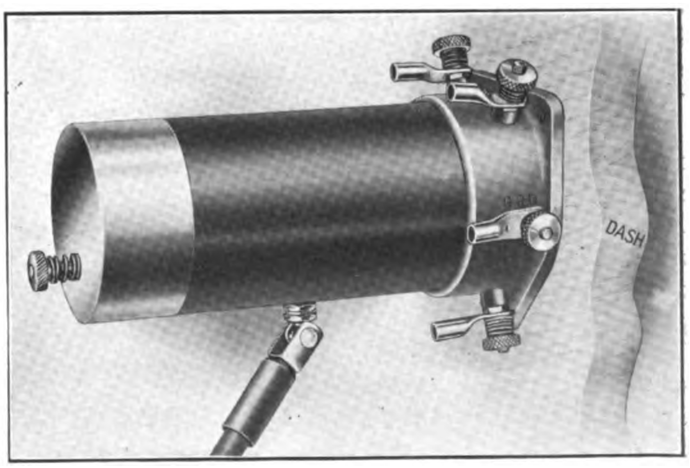


Fig. 35—Dash Coil Employed with Connecticut Igniter Distributor.

scribed, but the construction differs in that contact is made between the arm member and segments instead of utilizing a gap. In many respects the igniter is similar to the magneto in the method utilized for breaking or interrupting the primary current and distributing the secondary or high-tension electricity. With the igniter system a dash coil is employed, and a back view of one of these members is shown at Fig. 35. The igniter is depicted at Fig. 33 and the wiring plan at Fig. 34.

With either of the high-tension distributor systems outlined the time of spark may be changed; that is, it may be made to occur earlier in the combustion chamber as with the timer and multiple coils. This advance of the time of spark is brought about by moving the housing or casing of the distributor in the direction opposite to that in which the arm is rotating, bringing about an earlier closing of the primary circuit and building up the secondary current. This advancing of the spark as it is termed is brought about by suitable connections between the control lever on the steering wheel and the distributor housing.

(To Be Continued.)

Ed. Note—The next installment will deal with the master vibrator, explaining its construction and operation.

TO MANUFACTURE STEEL BAR.

New Concern Organized at Canal Dover, O., to Produce Material for Automobile Work.

A new concern, capitalized at $1,200,000, to be known as the Dover Superior Steel Company, has closed negotiations to locate its plant at Canal Dover, O., and will employ 600 men. The promoters of the company are all well known and practical steel men of Pittsburg, Penn., including W. M. Parkin, H. T. Myer, Archie Smith and M. S. Young.

The concern is to manufacture steel bar for automobile chassis and steel furniture. The metal will be received at its plant direct from the Canal Dover furnace and in its molten state. Thirty-five acres of ground adjoining the furnaces have been secured for the erection of the plant.

The San Francisco Motor Truck Association is the name of an organization of the motor truck men of that city, formed recently at a well attended meeting of the local representatives. There was considerable enthusiasm displayed and it was the general belief that there was a very wide field for the activities of such an association. Officers were elected as follows: President, Charles B. Lewis, Lewis Motor Truck Company; vice president, C. E. Osborn, Speedwell Motor Car Company; secretary-treasurer, Harold D. Knudson, J. W. Leavitt & Co. A committee of five, with President Lewis as chairman, was appointed for the purpose of drafting a constitution and bylaws and to gather data from eastern truck associations.

INTERESTING LAFRANCE TEST.

Demonstrates Value of Hydraulic Transmission as Well as Saving in Time and Traffic Space.

A LaFrance hydraulic truck, made by the La-France Fire Engine Company, Elmira, N. Y., recently gave a demonstration at New York City, when it hauled 45 tons over a route approximately four miles long. This performance is interesting as showing not only the capabilities of motor traction, but also exhibiting the possibilities of hydraulic transmission. It is claimed that no power in mechanics has yet been found to exceed hydraulic power and while the concerns now making use of the Manly transmission idea have not made the progress that will probably result later, the feature is being watched keenly by the motor truck interests.

In the test mentioned, 45 tons were hauled from the New York city hall to 67th street and the East Side. The truck itself, weighing 4.5 tons, was loaded with six tons of boiler fittings, while behind was attached a wagon weighing 12.5 tons and carrying a boiler weighing 22 tons. At least 20 horses would have been required to haul this load. They would have occupied at least 250 feet on the streets and would have effectively blocked all traffic while they were passing.

The LaFrance truck was only 20 feet long, so that there was over 230 feet of street space saved. Further, the run was made with the truck in half the time that horses would have taken, which means that the streets were in use only half as long. Thus the test proves that the hauling of heavy materials through the streets of big cities by heavy motor trucks, either with or without trailers is of advantage not only to the owners of the trucks, but to the people who use the streets.

COMPETING WITH RAILROAD.

KisselKar Operating with Success in This Field in Southwestern Connecticut.

The motor truck in interurban traffic is becoming a most formidable competitor of the railroad. Instances of large industries that are now using the truck in short cross country runs are numerous, a recent and typical case being that of the Weidman Brewing Company of New Haven, Conn.

This company employs two four-ton KisselKar trucks, made by the Kissel Motor Car Company, Hartford, Wis., between New Haven and the neighboring cities of Bridgeport, and Ansonia, whereas the railroads were formerly relied upon for deliveries to customers at these points. The machines carry their cargoes directly to the door of the patron, while under the old method two additional handlings were necessary. Each truck makes 75 miles daily with 12 to 14 deliveries.

Municipal Service Equipment

G. M. C. HORSE AMBULANCE.

Detroit and New Orleans Only Cities That Have Installed Vehicles of This Type.

Citizens of Detroit are grateful to Miss Stella Fors for her gift of a new motor horse ambulance to the city. There is only one other car similar to it in the entire country and that is owned by the Society for Prevention of Cruelty to Animals at New Orleans, La. Both machines were made by the General Motors Truck Company, Pontiac, Mich.

Across the blue panelling in police colors is printed "Animal Welfare Ambulance." The car is provided with a movable floor, which slides on rollers under a stricken animal to lift it into the body of the car. If an animal is able to walk its ascent into the ambulance is an easy, gradual one, and to prevent the necessity of backing it out a side door is provided for the exit.

FULFILLS ALL EXPECTATIONS.

Fire Commissioners in Springfield, Mass., Well Satisfield with Present Equipment and Will Add More.

The annual report of the fire commissioners and Chief Daggett of Springfield, Mass., devoted much space to the consideration of motor driven fire vehicles. The department now has but a few pieces of horse drawn apparatus in service and it is recommended that these be replaced by motor fire machines. The fire commissioners expressed gratification that the introduction of motor driven apparatus has effected a saving to the city commensurate with the original estimates when the subject of such equipment was first considered locally and concluded with the following:

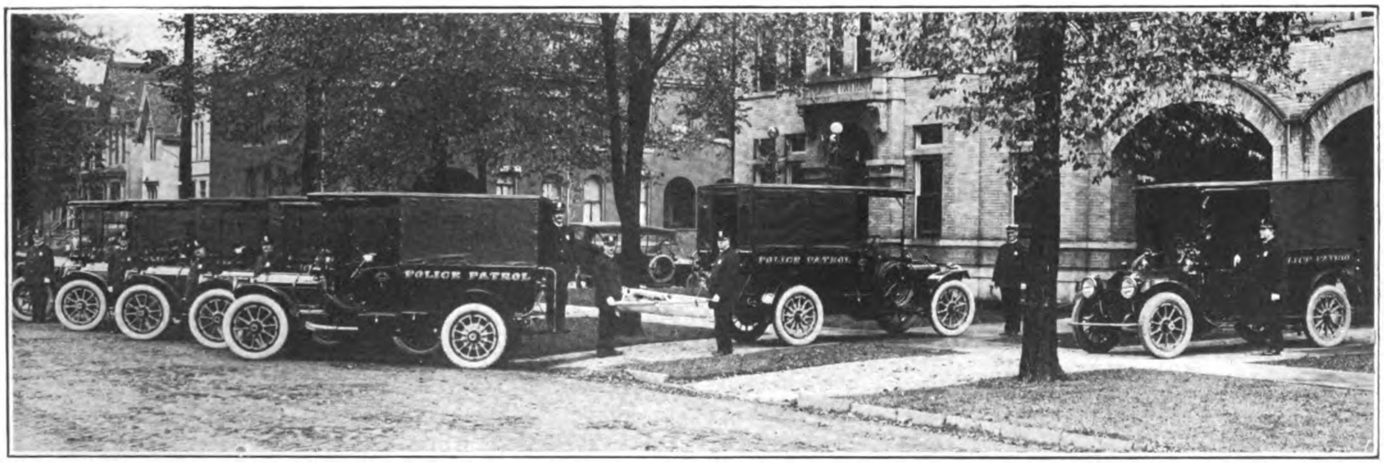
"Of the motor fire apparatus now in service there is nothing to be said except that it has given complete satisfaction throughout the year. As so-called comparisons of the cost of maintenance between motor and horse apparatus are so overwhelmingly in favor of the motor pieces, no attempt has been made to present such a statement herewith."

PACKARDS IN POLICE SERVICE.

Detroit Department Finds Each Is More Efficient Than Three Horse Patrols.

An accompanying illustration presents a portion of the Packard patrols, made by the Packard Motor Car Company, Detroit, and in service with the police department in that city. These machines have been in use nearly two years and others have been added since this photograph was taken. Practically all of the emergency ambulance calls in the city are handled by these cars, and the number of sick and injured carried in a year is approximately 3000 persons, in addition to the ordinary calls of a police patrol.

According to Fire Commissioner Frank H. Croul, these seven vehicles cost the department $6481.73 for



Seven Combination Ambulances and Patrol Wagons, Made by Packard Motor Car Company and in Service with Police Department in Detroit.

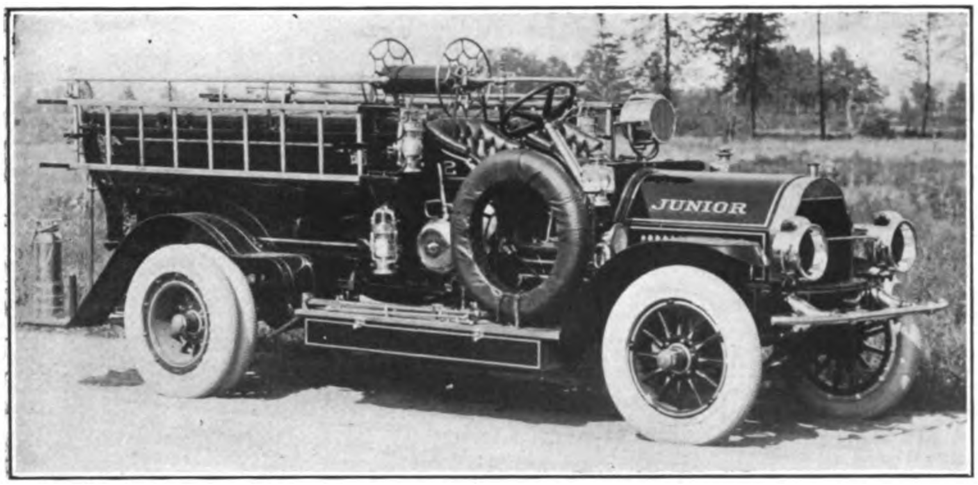
one year, this sum being divided as follows: Tires and tire repairs, $3760.74; miscellaneous repairs and painting, $968.20; gasoline, $1487.58; lubricants, $265.21. They responded to a total of 32,939 calls and covered 81,599 miles.

"One motor car with two men," says Mr. Croul, "will cover as much territory as three horse drawn wagons with six men and give vastly better service. We have worked out a dovetail dispatching system by which the cars may be shifted rapidly as the need of the hour demands. The largest factor of saving is the reduction in the number of men. I wouldn't care to handle this department any longer if I had to give up the motor patrols. Every horse has been eliminated."

KNOX FOR SMALL TOWNS.

Type of Combination Fire Fighting Apparatus That Has Enjoyed Wide Popularity.

Herewith is illustrated a Knox model M-3 combination hose and chemical wagon, made by the Knox Automobile Company, Springfield, Mass. This is a type of vehicle which has enjoyed wide popularity in small towns and in cities for covering outlying districts, etc. It has a maximum road speed on pneumatic tires of 40 miles an hour, or 30 miles on solid tire equipment.



Knox Model M-3 Combination Hose and Chemical Wagon, Fitted with 50 Horsepower, Four-Cylinder Motor.

The wheelbase is 145 inches and tread 60. The motor is a Knox four-cylinder model M rated at 50 horsepower, with bore and stroke of 5.5 inches. The transmission is of the special heavy selective type, affording three forward speeds and reverse. Final drive is by double side chains to the rear wheels. The approximate weight of the chassis is 6000 pounds, and two types of body are fitted. One is with one 35-gallon chemical tank, like that in the illustration, which is eight feet five inches long by 50 inches wide. The other has two tanks of the same capacity, and is seven feet by 50 inches.

The equipment includes 200 feet of chemical hose with basket or reel, two three-gallon hand extinguishers, acid bottles, soda bags, roof ladder, extension ladder, siren, locomotive bell, horn, headlights, searchlight, side and rear lamps, Prest-O-Lite tank (all lights electrically ignited from switch on dash), speedometer, firemen's lanterns, axes, crowbars, tools, extra parts, etc. It has capacity for 800 to 1000 feet of regulation 2.5-inch fire hose and 10 to 12 men.

MARSHALLTOWN COMPARES COSTS.

KisselKar Maintenance a Month Less Than Average Upkeep of Horses a Fire.

Chief I. T. Kirby of the fire department of Marshalltown, Ia., has submitted to his city government a report comparing the cost and efficiency of a KisselKar hose and chemical wagon with the horse drawn vehicle which it replaced. Chief Kirby, in his report, shows that during the period between April 1 and Dec. 1, 1912, there were 69 alarms. Comparing the cost of maintenance during the eight months of the previous year he presents the following figures:

Cost of maintaining team, eight months, including feed, shoeing, harness and veterinary service, $331.36; cost of maintaining automobile, eight months, including gasoline, oil, Prest-O-Lite and repairs, $25.17; cost of maintaining automobile, a month, $2.09; cost of maintaining team, a month, $41.42; cost of maintaining automobile, a fire, 36 cents; cost of maintaining team, a fire, $4.80; balance in favor of automobile, a fire, $4.44; balance in favor of automobile, a month, $39.33; balance in favor of automobile, a year, $471.96.

These figures are of particular interest as indicating in no uncertain terms the economy effected by utilizng automobile equipment.

NEWS OF GENERAL INTEREST.

No Horses in Five Years—Within five years not a single horse will be in use by the fire department in Cleveland, O., is the prediction of Safety Director C. W. Stage. The work of motorization is now under way and $45,000 will be expended for additional apparatus. Eight motor vehicles are to be purchased for the fire department and the police department is authorized in a separate appropriation to secure four automobile patrol wagons. Two flying squadrons will be equipped out of the $45,000 appropriation and new companies will be established.

Saves Dollar a Day—Fire Chief Chase of Northampton, Mass., in his recent report relative to the motor fire apparatus in use in that city, states that during the six months it has been in service the cost of

maintenance has been $5 a month and compares this with a cost of $36 a month for maintaining a pair of horses. The complete report of Chief Chase brings the question closely to the point of asking whether the city can afford to maintain any horse drawn apparatus in its engine houses. So impressive have the figures proved that the neighboring town of Easthampton, Mass., will probably consider at the coming annual town meeting the installation of automobile fire apparatus.

Meriden Would Replace Horses—The tax board of Meriden, Conn., has voted to motorize the fire department of that city. For some time the fire department has had in use a big Webb motor fire engine, made by the Webb Company, Allentown, Penn., and although it was more or less of an experiment, it has been successful in spite of careless handling, hard usage and other adverse conditions. It was its demonstration of quick and efficient service that led the tax board to declare in favor of a motorized fire department.

KisselKars in Milwaukee—Two new KisselKar patrol wagons, built by the Kissel Motor Car Company, Hartford, Wis., have been placed in commission by the city of Milwaukee, Wis. These make a total of five KisselKars in the service of that city. Two others are used in the water department and one does the runabout business of the public library. The new patrol bodies surmount regular two-ton truck chassis with the exception that the motor is the Kissel six-cylinder, instead of the four-cylinder type commonly used.

Springfield Police Purchase Car—The police commission of Springfield, Mass., has purchased a touring car, made by the Knox Automobile Company of that city, for the use of the chief of police and members of the detective bureau. A new patrol wagon for the department is being built along special plans by the Knox company. In negotiating for this the police department saved $500 out of its appropriation for the purpose and a considerable surplus was shown over the annual appropriation of the department. Permission was obtained to use this money for the police touring car, the need of which has been felt in police work for some time.

Augusta Wants New Apparatus—Chief Frank G. Reynolds of the fire department in Augusta, Me., in his annual report praises the work done by the motor driven fire apparatus and recommends the replacement of some of the present horse drawn vehicles by automobiles, also a new fire station in the hill section of the city, to have two motor wagons in service. The apparatus recommended for the new hill station are a modern motor pumping engine to carry 1000 feet of 2.5-inch hose and all necessary equipment; and a combination truck to carry a 50-foot extension ladder, 60-gallon chemical tank, 250 feet of chemical hose, hand extinguishers and a full equipment of ladders ranging from a 12-foot scaling roof ladder to the 50-foot extension.

Abbott-Detroits for Denver—The city of Denver, Col., has placed an order with the Abbott Motor Company, Detroit, maker of Abbott-Detroit machines, for four 34-40 three-passenger roadsters for use by assistant fire chiefs. The cars are to be painted pure white with gold stripes and red wheels and no time is being lost in filling the order.

White Machine for Malden—A new White fire truck, known as Combination B, made by the White Company, Cleveland, O., has been put in commission by the city of Malden, Mass. This apparatus is mounted on the standard White 40-horsepower fire truck chassis and is equipped with the very latest mechanical aids to effective fire fighting. It has an electric starter and electric lights, is shaft driven and has the centre control with left-hand drive.

Buffalo Adds to Equipment—Plans are being considered by the fire commissioners of Buffalo, N. Y., for the substitution of motor driven apparatus for the old horse drawn machines, including automobile runabouts for use of the battalion chiefs. Reliability and efficiency as shown by the motor engines have solidly established them as factors in the fire fighting service of Buffalo. The first big truck to be placed in action will probably be of the 85-foot extension type for use in the business district and at least one to be added soon will be of the gasoline pumping type. Still another machine will be a gasoline driven steam pumping engine.

Webb Combination for Lynn—The city of Lynn recently accepted for service a new $9000 combination pump and hose wagon, built by the Webb Company, Allentown, Penn. It is the latest type on the market and weighs eight tons. It is equipped with a six-cylinder, 90 horsepower engine capable of driving it at a rate of 60 miles an hour, fully equipped and with a crew of 16 men besides the driver.

Kelly-Springfield for Fire and Police—The city of Springfield, O., has awarded to the Kelly-Springfield Motor Truck Company the contract for two automobile hose trucks for the fire department and one automobile police patrol as well.

In the Market—Among the cities in the market for the purchase of motor apparatus are the following: Alameda, Cal.; Providence, R. I.; Temple, Tex.; Marlboro, Mass.; Evanston, Ill.; Rumford, Me.; Needham, Mass.; East Liverpool, O.; Monongahela, Penn.; Appleton, Wis.; Harrisburg, Penn.; Akron, O.; Chelsea, Mass.; Franklin, Penn.; Des Moines, Ia.; Roseburg, Ore.; Cosmopolis, Wash.; Attleboro, Mass.; Michigan City, Ind.; Stockton, Cal.; Morristown, N. J.; Aurora, Ill.; Madison, Wis.; Racine, Wis.; Oshkosh Wis.

New Commercial Car Accessories

Gilmer Endless Belt.

The L. H. Gilmer Company, 52 North Seventh street, Philadelphia, is manufacturing the Gilmer endless belt, which is constructed especially for model T Ford automobiles. It is woven of a material which is held to be water and oil proof and a quality claimed for it is that it will not stretch after considerable service. The maker holds that it will grip the pulleys even when loose and that it is not necessary to adjust it tightly. It is also pointed out that it will give maximum service when allowed to run slightly slack on the pulleys. The Gilmer woven endless belt is inexpensive.

J-M Keystone Radiator Shield.

The J-M Keystone radiator shield is the product of the H. W. Johns-Manville Company, New York City, and is applicable to both pleasure and commercial vehicles. It not only protects the radiator by preventing freezing of the water, but makes for easier starting as the heat is retained for a considerable period. It consists of a neat, thick, quilted pad, formed by a layer of thoroughly cleansed cattle hair which is held to be one of the best known insulators against cold. This is stitched securely between water proofed imitation leather and the entire design fits snugly against the radiator. It is provided with an adjustable flap which permits of entirely closing the cover when operating the car in extreme cold weather. On mild days the flap may be opened, thereby securing ample radiation. A quality of the cover is that it may be easily and quickly fitted or detached, and its compactness enables folding and placing under the seat when its use is not desired. It is made in three sizes, these being 26 by 27 inches, 22 by 23 and 20 by 21.

Perfect Gasoline Filter.

A gasoline filter that differs from those of conventional practise is that manufactured by the Gasoline Filter Company, 145 West 45th street, New York City. Although the filtering element is chamois, it is arranged in the form of a bellows to a free end of which is attached a small rod extending through the filter casing. The other end of the chamois being fixed, it follows that movements of the rod alternately compress and extend the bellows, expelling all fluid from their interior. This cleans the filter material much in the same manner as one would rinse a cloth. The fuel enters the lower inlet and passes through the fine chamois to an outlet to the carburetor. All foreign elements, including water, fall to a reservoir fitted with a drain cock. The filter is easily incorporated in the main line as compression screw attachments are utilized in place of the usual soldered connections. A quality of the device is the fitting of an air vent at the top of the housing, and by removing the screw after installation any air in the line may be expelled. The essential tools in fitting the filter are a hacksaw and a small wrench. It is neatly finished in nickel, very compact and moderately priced.

Vim Motor Starter.

The Vim Manufacturing Company, Cleveland, O., is marketing a motor starter of the acetylene type. The cylinders of the engine are primed with the proper proportions of gas and air and the mixture is ignited by a spark in the conventional manner. The acetylene is led from the tank to the dash, thence to the intake manifold of the motor. The control unit is of special construction and is held by the maker to be highly efficient. It is not only easily operated from the seat, but the maker claims that it is impossible for any acetylene to escape. The dash device is very neat, comprising a numbered dial and a lever. By moving the latter to the proper number the desired mixture is secured. The Vim motor starter is very compact, weighs slightly over a pound and the maker states it may be fitted in 30 minutes and without the aid of special tools.

Dover Safety Fuel Can.

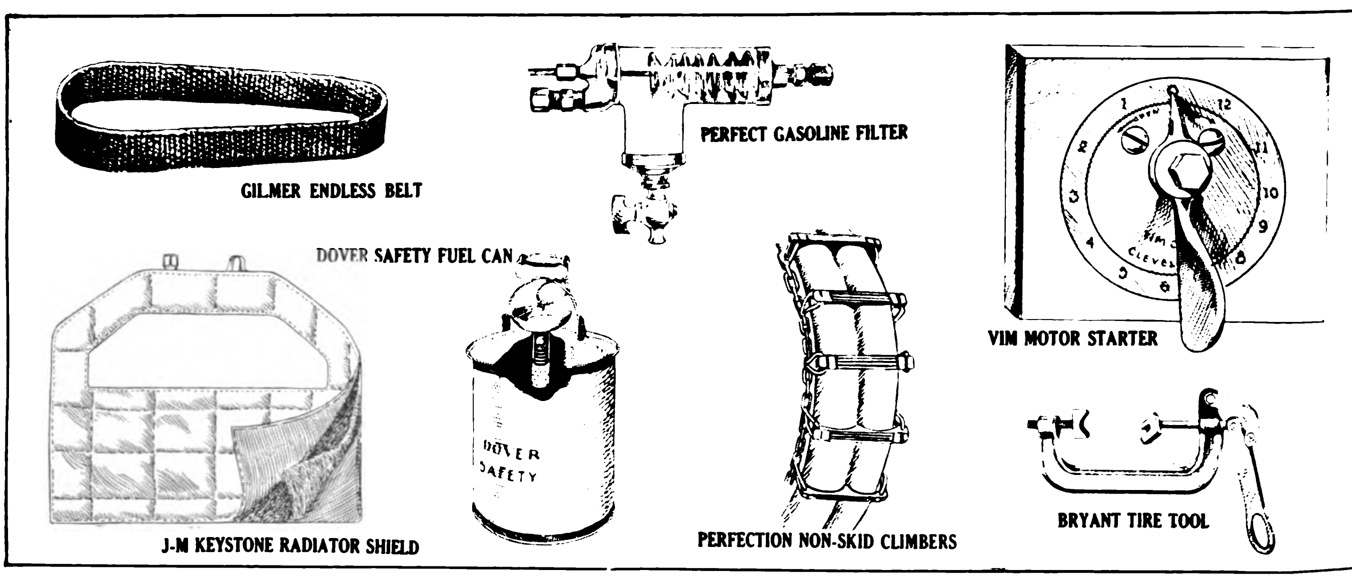
Among the new products of the Dover Stamping & Manufacturing Company, Cambridge, Mass., is the Dover safety gasoline can. One of the interesting and practical features is the self-closing attachment which not only prevents evaporation of the fuel, but eliminates opportunity of explosions. The device comprises a large brass ball ground into a valve and normally held closed by a spring. The valve member is surrounded by a gauze chamber, preventing fire reaching the vapor of contents of the can when pouring or filling. In the five-gallon size the valve opens and closes automatically when pouring, but cannot open accidentally. On the one-gallon and one-quart sizes the valve is held open by a slight pressure of the thumb, closing when released. The cans are constructed of heavy galvanized steel, painted red and stencilled "Gasoline." Economy of fuel is effected by air tight qualities. The containers are moderately priced.

Bryant Tire Tool.

Stevens & Co., 375 Broadway, New York City, is marketing the Bryant tire tool which presents a number of practical features in that it may be employed for removing rims as well as the shoes. It is universal in that it will fit all styles and sizes of rims, and will remove and replace them with little exertion. It is fitted with tire and rim engaging devices, one carried by a slide shaft and the other on an adjustable screw, the latter being adapted for tires from four to six inches. The slide shaft passes through a guide hole and forces the wedge member downward into the bead, and it is held that it will not ride upward and injure the thin wall of the casing. Considerable leverage is secured through the construction of the tool which, after forcing back the ring member, locks automatically. This is of considerable value in that it enables the operator to employ both hands in working on the rims, etc. One of the qualities emphasized with the tool is its adaptability for forcing the rusted bead of a tire away from the inside of a rim and operating the tool from the outside of the wheel. The tool is very compact, constructed of high grade material and is inexpensive.

Perfection Non-Skid Climbers.

Perfection non-skid climbers are produced by the Perfection Non-Skid Climber Company, Edon, O. They are designed both for single and dual solid shoes and the company claims that the mechanical principle involved in the construction is such that they check instantly and automatically all sliding, skidding or slipping. The device comprises three working parts and it is held that they may be fitted or removed easily and quickly. The traction or cross shoe members are in the form of a corrugated plate and are secured by side links on either side. The links are retained by a chain construction and means are provided for fitting the same. They are made in widths varying from two to five inches and for wheel diameters of from 28 to 42. The duals are 3.5 and four inches respectively. An attaching tool is listed as extra.



Presenting Accessories Adaptable to the Commercial Vehicle, Including Dover Safety Fuel Can, Perfect Gasoline Filter, Vim Motor Starter, J-M Keystone Radiator Shield, Gilmer Endless Belt, Etc.

FOREIGN TRUCK NOTES OF INTEREST

INTERESTING GERMAN CHASSIS.

Five-Ton Daag Machine Presents Distinctive Features of Design and Construction.

While in some respects the Daag trucks, made by the Deutsche Last Automobil Fabrik Aktein-Gesellschaft of Ratingen, Dusseldorf, Germany, is not new in the country of its origin, the five-ton chassis presents distinctive features. It may be stated that the designer was at one time employed at the Saurer works in Switzerland, and some of the characteristics of that machine are reflected in the German vehicle.

Perhaps the chief feature of the motor, which is a four-cylinder, four-cycle unit, otherwise following what may be regarded as conventional practise, is the provision of an air braking device. This is an arrangement for temporary endwise displacement of the camshaft in such manner that air is drawn into the cylinders and compressed on each stroke. This is similar, at least, to the Saurer construction.

The control of the vehicle has been simplified materially. The one lever, which is pivoted at the centre of the steering wheel, controls, during the first part of its operation, the opening and closing of the throttle, which is embodied in the special Daag carburetor. When this throttle is closed, the same simple lever goes on to open a bypass to the atmosphere and to commence the displacement of the camshaft for air braking. A small subsidiary movement, interconnected with this lever mechanism, effects an alteration of the passage over the jet in the carburetor.

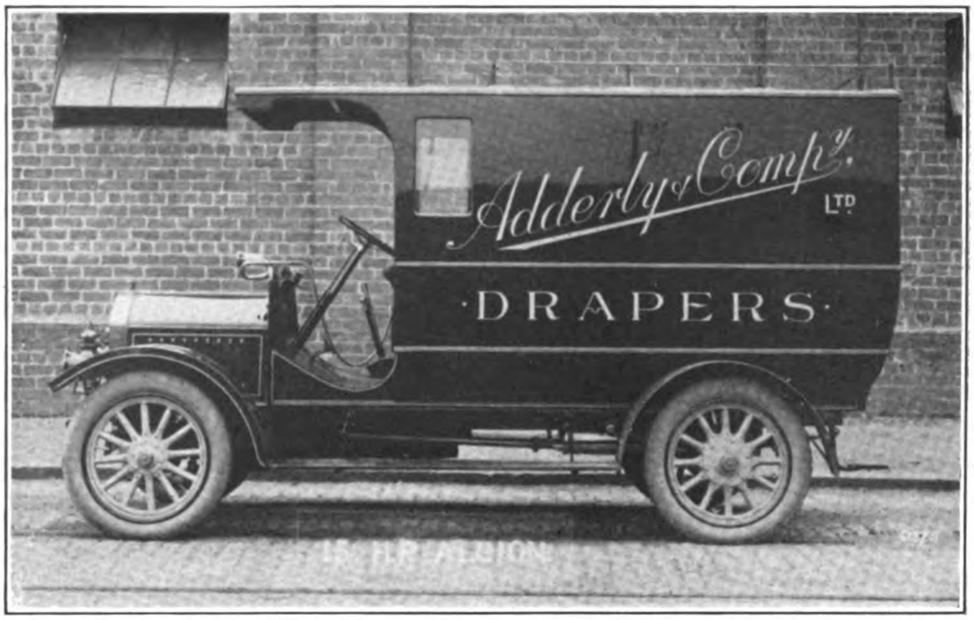
The carburetor is said to be adaptable to differing fuels. The ordinary float feed keeps the jet supplied with fuel in the usual way, but the jet is fitted with an internal tapered plunger, by which minute adjustment of the effective orifice is readily obtainable. This is separately controlled by a small lever carried on the dash. It is this special form of jet, in conjunction with the throttle arrangement, which is held to make possible the use of gasoline, benzol or alcohol.

The remainder of the chassis is of more or less conventional design, making use of a cone clutch, four-speed selective transmission, double chain final drive, countershaft and rear wheel brakes, etc. Because of the special type of carburetor, very economical fuel consumption is claimed, and this is further aided by the liberal use of high capacity ball bearings throughout the machine.

ALBION WORM DRIVEN.

Well Known Scotch Firm Adopts This Type for Light Delivery Wagon Work.

While the Albion Motor Car Company, Ltd., Scotstoun, Glasgow, Scotland, one of the oldest makers of commercial motor vehicles in the United Kingdom, always has made use of the chain drive, it has announced a new light delivery wagon equipped with worm driven rear axle. The company explains that it believes the chain drive cannot be excelled for heavy duty work, but adds that it has produced this latest model to meet the demand for a light, speedy, quiet vehicle.



Albion Worm Driven Light Delivery Chassis Equipped with Box Van Body.

The car is shown in an accompanying illustration. It has a four-cylinder, en bloc motor, rated at 15.8 horsepower under the Royal Automobile Club's formula, which is the same as that adopted by the Society of Automobile Engineers in this country. The bore is 3.125 inches and the stroke five, giving a bore to stroke ratio of 1:1.60. Cooling is by water, lubrication by gear driven pump and ignition by high-tension magneto with flexible drive.

The clutch is of the single disc type. The transmission gives three forward speeds and reverse, control being by a single lever on the gate system. Final drive is by an overhead worm and worm wheel run-

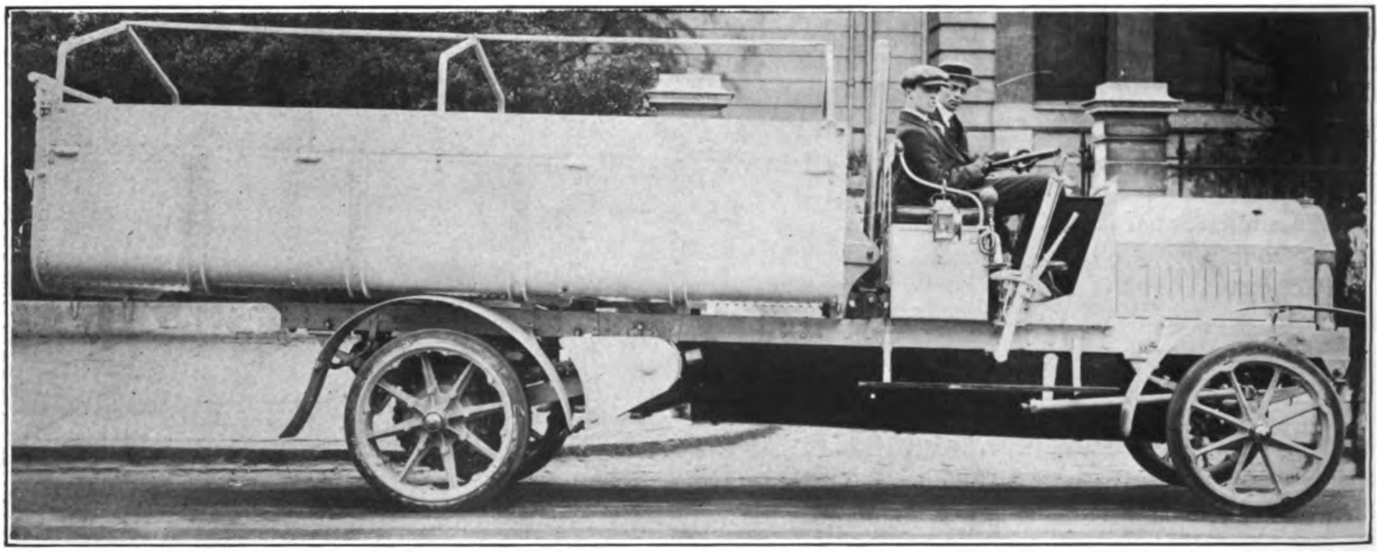
ning in oil and carried in special strong casings. Ball or roller bearings are used throughout and ball thrust washers take the thrust.

Wheels are of wood, artillery type, and pneumatic tires are fitted both front and rear, or solid members of ample section may be had on the rear upon option. The foot brake is external contracting, operating on a drum on the propeller shaft, while the hand member is internal expanding, acting on drums fixed to the rear wheel hubs. The frame is of pressed steel, with suitable pressed steel and tubular cross members.

LACRE STEEL TIPPING BODY.

An Interesting Installation Made by British Concern for South African City.

A new type of dumping body, constructed of steel and intended mainly for use in collecting and disposing of refuse, is that made by the Lacre Motor Car Company, Ltd., Letchworth, Hertshire, England, for the city officials of Johannesburg, South Africa, and shown herewith in two views. The municipality has found the wagon a decided success, both as to mechanical details and in a saving in time and labor.



Lacre Four-Ton Chassis Fitted with Steel Tipping Body for Collecting Refuse in Johannesburg, South Africa.

The chassis is a regulation Lacre four-ton, fitted with a 38 horsepower, four-cylinder, water-cooled motor. Ignition is by high-tension magneto. The clutch is a cone faced with leather and of large dimensions. The transmission gives four forward speeds and reverse, the three high speeds being operated by positive dog clutches. The reverse is obtained by manipulating a separate lever. Final drive is by means of roller side chains. Two sets of independent double-acting brakes are provided.

For use with this body the frame is shortened a trifle and stiffened at the rear to permit of tipping. The body dimensions are: Length, about 12 feet six inches; width, seven feet; depth, two feet nine inches. The rear portion is so arranged that when the vehicle is tipped it opens automatically, and it is held closed by a lever when in normal position. The screw hoist is of the telescopic type and permits of a body elevation of 45 degrees. Each of these vehicles replaces 12 Scotch carts and 20 mules.

INTERESTING SOUTH AMERICA.

Pope-Hartford Man on Trip Following Visit of Officials of That Section to Hartford Plant.

With a view to interesting South American cities in motorizing their various fire, police and municipal departments, as well as making a study of the commercial vehicle situation below the Canal zone, President George L. Dodd of the Pope-Hartford Company of Boston, recently sailed on a 28-day trip to that region.

Many South American officials have visited the Pope-Hartford Company and have displayed great interest in the ladder trucks, ambulances, chemical apparatus, etc. They stated their section possessed excellent possibilities for motor apparatus and Mr. Dodd's itinerary will cover 6832 miles and include: Havana, Cuba; Kingston, Jamaica; Colon, Panama; St. Pierre, St. Thomas and other South American points.

MORELAND IN HONDURAS.

California Product, the First to Enter That Country, Will Carry Government Mails.

H. E. Dean, who has had the contract for carrying the government mails in Honduras, Central America, has purchased a Moreland truck, made by the Moreland Motor Truck Company, Los Angeles, Cal. The capital of Honduras is a city situated in the heart of the country and is known by the strange name of Tegucigalpa. In order to receive mail from the outside world it has been necessary to haul it from Amapala, on the seacoast.

The Moreland truck is the first to invade Honduras and thus is the only motor driven vehicle in use in the country. From Amapala to Tegucigalpa runs the only good road in the entire country, the distance between the two cities being 115 miles. For 55 continuous miles this road is uninhabited and as the country lacks service stations, the truck must demonstrate the utmost dependability.

Mr. Dean plans to make the round trip in two days, thus giving the capital three deliveries of mail each week. With the native horse teams it formerly required a week to make the round trip, so that the service has been tripled by the introduction of this one truck. Passengers will also be carried and to guard against the frequent rain the machine has been given a cover of canvas.

WORM DRIVE IN CANADA.

First Machine Made in Dominion Utilizing This Construction Shown in Montreal.

The recent automobile show in Montreal, Canada, served to call attention to a new Canadian worm driven machine, made by the Northern Motor Car Company, Kingston, Ont. The Northern was shown in three models, of one, two and three tons capacity. Three others are produced, these being rated at 1.5, 2.5 and 3.5 tons.

The six machines differ materially from each other in that the one and 1.5-ton vehicles have unit power plants and four-speed transmissions, and the others have separate motor and transmission construction with three speeds forward and reverse. They follow standard construction in the main. The worm is of steel and the wheel of phosphor bronze. Motors are the long stroke, four-cylinder, four-cycle type.

GENERAL NEWS FROM ABROAD.

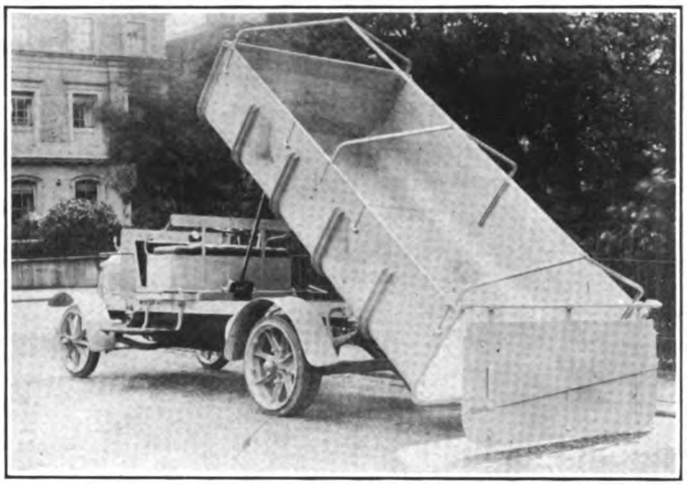
Trucks for Indian Mill Owners—It is stated that the owners of mills in various section of British India are studying the advantages of motor transports with a view to purchase. For some time these men have been aware of the disadvantages of their present means of haulage, but the belief that European drivers and attendants would have to be secured in order to obtain successful operation has prevented decision in favor of motors in the past.

Motors in South Africa—The British trade commissioner for South Africa has reported to his government that the market in that territory appears to offer great possibilities for commercial motor vehicles, and advises that British firms form an organization for its exploitation.

Transport Facilities at Liverpool Docks—In view of the recent discussion concerning the congestion of traffic at the docks in Liverpool, England, and its possible solution by the use of motor transports, the Liverpool chamber of commerce has decided to form a committee, consisting of members of its body, the corporation of the city and the shipping and other trade interests, to look into the matter.

Motor Omnibuses in China—A Chinese firm has requested information from British manufacturers concerning three or four 36-passenger motor 'buses, complete with bodies and tires. Inasmuch as this is held to be the first installation of such equipment in that country, it is believed that the future of the market will depend largely upon the placing of these vehicles.

Business Vehicles in Brazil—According to the local press the use of motor transports is increasing rapidly in Brazil. There are 442 automobiles for hire and 39 motor trucks in Santos, and 264 of the former and 80 of the latter in Sao Paulo. Motor services are running on the following routes: Aperecida to Guaratingueta, Capivari to Monte-Mor, Itu to Salto, Monte-Mor to Elias, Fausto to Reboucas, Paraibuna to Sao Jose dos Campos, Riberao Preto to Sartaosinho, Limeira to



Lacre Tipping Body in Dumping Position.

Piracicaba, Taubate to Tremembe and Porto de Rei to Itanhaen.

Agricultural Trials in Italy—The Ministry of Agriculture, Industry and Commerce in Italy, will superintend a trial of agricultural motors at Parma during the coming summer. The exact dates have not been made public, but all entries must be filed with the secretary of the Italian Touring Club, Via Monte Napoleone 14, Milan, Italy, before May 31. The competition will be divided into three classses, one for deep plowing, one for motors suitable for agricultural purpose and one for machines using kerosene or gasoline as fuel.

The Atlantic Ice & Coal Corporation of Atlanta, Ga., has just placed an order for 15 White trucks to be put into immediate service by the company. R. W. Woodruff, purchasing agent of the company, closed the contract with R. H. Johnson, New York City manager of the White Company's branch. The vehicles ordered are of the three-ton and 1.5-ton types.

HINTS FOR PROPER MAINTENANCE

A Department for the Owner, Driver and Repairman.

FUEL AND COLD WEATHER.

One cannot be too careful about the fuel in cold weather. This applies both to the operator and the garage attendant. The careful driver will make sure that all gasoline is strained before being poured into the tank, even going so far as to personally supervise the operation. While this would appear a needless precaution, an instance took place recently where the garage attendant neglected to use the chamois in the funnel, creating considerable trouble for the driver of the truck.

Having occasion to make a stop and one requiring some 30 minutes, the operator stopped his motor and blanketed it as it was a very cold day. When he returned and attempted to restart the engine there was trouble. Repeated cranking and even priming of the cylinders failed to obtain the desired results. After exhausting his knowledge of starting methods the driver telephoned to the garage for assistance.

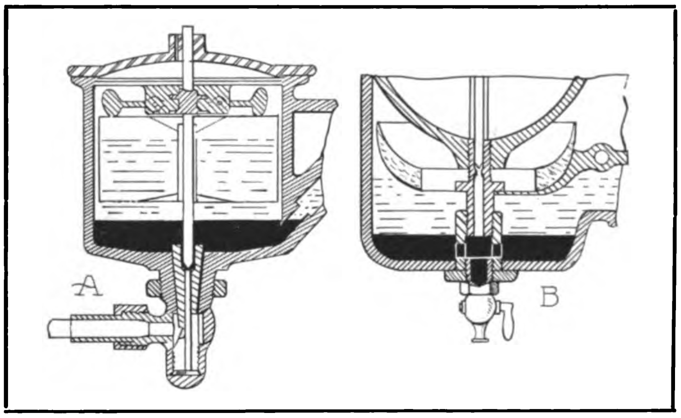


Fig. 1—Illustrating the Importance of Keeping Fuel Free from Water in Cold Weather: A, Showing Formation of Ice in Float Chamber, Stopping Passage to Spraying Nozzle; B, Depicting Level of Congealed Mass Above Apertures to Nozzle.

When the expert arrived he began a systematic search and located the trouble in the carburetor. Upon removing the member it was found that ice had formed to such an extent that the line leading to the spraying nozzle was choked. After thawing out the mass and cleaning the vaporizer the engine was started without difficulty.

All fuel should be strained carefully, more so in cold weather than in the summer. Not only should this precaution be observed, but the filter should be opened occasionally and all water and foreign elements drained from this member, as it is possible that the water will freeze and create trouble.

A simple test for frozen water in the carburetor is to open the petcock under the vaporizer and note if the fuel flows freely. If not, and the opening is free from obstruction, which may be tested by using a piece of wire, it may be taken for granted that ice has gathered. The only remedy is to remove the vaporizer and clean it.

At Fig. 1 A is presented an example of the possibility of ice forming in the carburetor, the congealed mass being denoted by the dark lines. It will be seen that the ice completely blocks the entrance of the fuel and that under this condition it would be impossible for the gasoline to reach the spraying nozzle and be converted into vapor.

At B is shown another design of carburetor. Here the fuel flows into the spraying nozzle through two small apertures. It would require only sufficient frozen water to cover these openings before the supply of fuel would be shut off. It should be remembered that water begins to congeal at 32 degrees Fahrenheit and that when the thermometer records well below this mark it requires but a short time for a small quantity to become a solid mass.

S WRENCHES AND THEIR USE.

With a complete set of S wrenches having various openings the work of overhauling the chassis or making adjustments is simplified, provided the workman has a knowledge of their proper application. A common fault with the novice is to employ a wrench that is too large; that is, the nut or bolt is smaller than the opening of the jaws of the tool. This results in damage to the nut by rounding off its corners.

In using the S wrench, or any other for that matter, the jaws should be fitted snugly so that there is no play. Sometimes it is necessary to give the free end of the wrench a sharp blow with a hammer to start a refractory nut and when this method is employed care should be taken to fit the tool so that the impact of the hammer will tend to drive the wrench on the nut, not off. If placed incorrectly the blow will cause slipping if not damage.

At Fig. 2 are shown several suggestions for tight-

ening or loosening nuts or bolts not easily accessible. Sketches A to F illustrate methods of securing greater leverage when tightening a nut and when it is impossible to accomplish the work with a single tool.

Frequently the nut is so located that a wrench cannot be utilized because of lack of space. At G, H and J are shown methods of doing the work, and it will require but little practise to master the operations. A rigid piece of metal should be employed, an iron or brass bar for example, and never the cold chisel, which will ruin the nut. The blows of the hammer should be sharp and clean, and the force applied for a brief part of a second is sufficient to start the nut or bolt.

The box wrench is of service when some foreign substance has become lodged between the threads of the nut and bolt, and when tapping with a hammer is necessary to loosen the parts. The wrench is fitted over the nut and receives the impact of the hammer, thus saving the nut from damage.

The work of removing a small nut or a union from light copper or brass tubing, the oiling or acetylene systems for example, requires considerable care on the part of the workman. With annealed copper or brass pipe it is an easy matter to twist the tubing, especially if the nut or union be set up snugly.

The best method is to fit a wrench and give the handle a light, quick tap with a light hammer. This will usually start the nut, etc., without danger of twisting the tubing. The same method should be utilized when removing a hub cap from a wheel. Some of these members are thin and if considerable leverage is exerted through a long handled wrench, the metal may become bent out of shape. On the other hand a more solid cap will resist the leverage and if a piece of pipe is slipped over the handle of the wrench to secure greater leverage, the spindle may become strained. There is a limit to stresses to which the S wrench may be subjected and these tools should be used properly and not unduly strained.

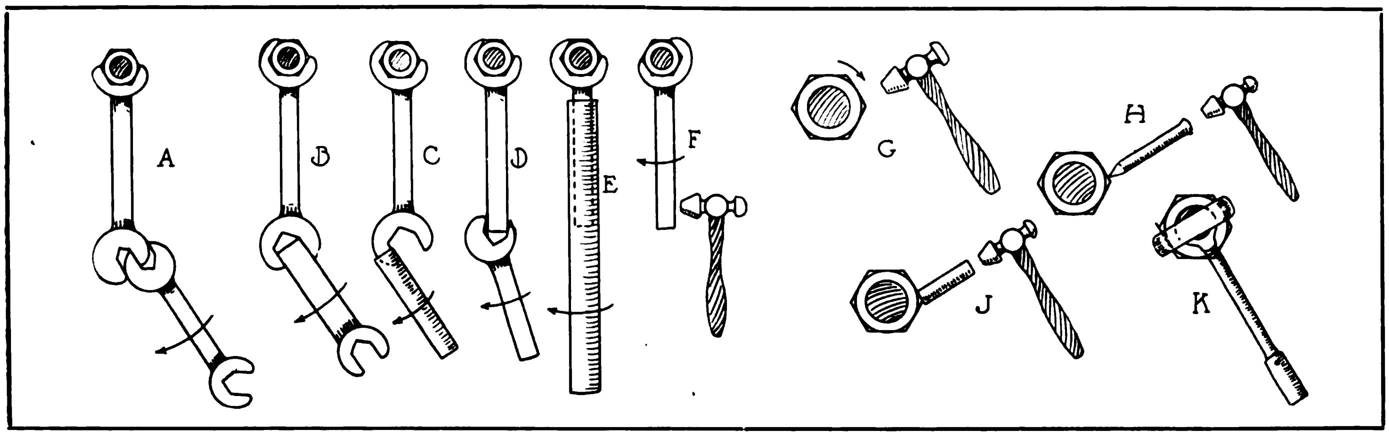


Fig. 2—Depicting the Proper Use of S Wrenches: A to F, Showing Methods of Obtaining Greater Leverage; G to K, Suggestions for Starting Frozen Nuts.

A STARTING SUGGESTION.

When flooding the carburetor and priming the cylinders with gasoline fails to start a motor on a very cold morning, heat should be applied to the carburetor and intake manifold. If convenient, heat some water very hot and after covering up the air intakes of the vaporizer, pour the heated fluid over it and the intake pipe. Then flood the carburetor and prime the cylinders and the engine will start, provided the ignition and other components are in proper working order. Heating the carburetor assists in the vaporization of the fuel, while warming the intake manifold prevents the vapor from condensing as it strikes the otherwise cold walls of the piping. The mixture should be enriched slightly for starting and after the motor has become warm the needle valve replaced in its original setting.

INSPECT WHEEL BEARINGS.

Wheels of the ball bearing type should be examined for looseness occasionally as there is danger of the balls breaking and the bearing becoming ruined. It is an excellent plan to jack up the wheels and test them for play. When ball bearings are employed the adjusting cone should be tightened until the wheel is absolutely stiff, then the cone should be slacked off about one-quarter of a turn and locked. The wheel should then be rotated, trying it in different positions to note if the bearing binds as it may be possible that the spindle is sprung. If the latter condition exists, it will be impossible to set up the bearing snugly without the balls binding on one side. Always clean out the old lubricant and replace with new, and be sure to replace cotter pin securing locking nut. In filling the hub cap care should be exercised not to use too much grease as it may prevent the cap from being screwed up tightly.

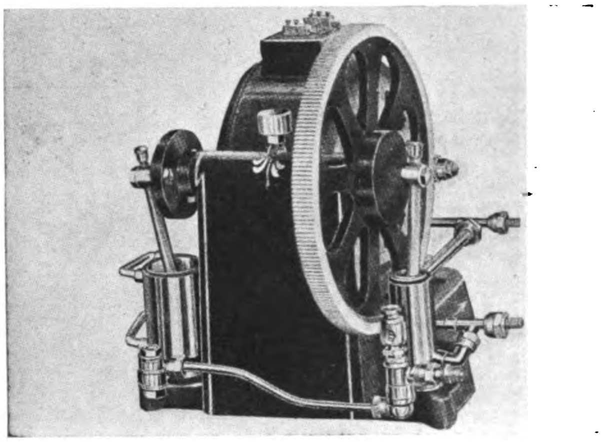
WHEN SPARK PLUG IS FROZEN.

Sometimes difficulty is experienced in removing a spark plug from the cylinder and frequently the porcelain is broken by a too vigorous application of the wrench, or if heat is utilized the insulator may be cracked. It is an easy matter to loosen the retaining nut of the electrode and remove the part, after which the shell may be handled in safety.

GARAGE AND SERVICE STATION EQUIPMENT.

CHAMPION ELECTRIC AIR PUMP.

An air compressor maintaining a constant supply in the tank, is a valuable addition to the garage equip-



Champion Automatic Compound Electric Air Pump Designed Especially for Garage Service.

ment as by it tires may be inflated, the chassis cleaned and numerous other forms of work completed with a saving of time and labor.

The Cleveland Faucet Company, Cleveland, O., manufactures an outfit especially designed for this work and in an accompanying illustration is presented the No. 6 Champion automatic compound electric air pump and automatic switch. It is held by the maker that the capacity of the tank is sufficient for the largest garage and that an 18-gallon container will furnish air enough to inflate a large tire every minute and at any pressure. A constant pressure of 100 pounds or less is maintained automatically and the pump operates only when the supply of air is reduced to a predetermined amount.

The compound pumps are back geared direct to the electric motor, and are constructed entirely of bronze with valves and connections of the same material. The pistons are water jacketed, maintaining a constant circulation of cool fluid, and a water tank eliminates the necessity of the continuous city supply. This tank is substantially constructed and is located approximately 1.5 inches above the return connection.

The automatic switch controlling the pump is simple in construction and the company emphasizes its durability, also the fact that it requires no other attention after installation than an occasional oiling. It is stated that the pump will automatically fill an 18-gallon air tank at the following pressures: Twenty-five pounds in three minutes, 50 pounds in eight minutes, 75 pounds in 12 minutes and 100 pounds in 16.5 minutes.

The specifications are as follows: Dimensions of pump, 15 inches wide, 19 inches deep and 18 inches high; switchboard, nine by 14 inches; diameter of large cylinders, 2.25 inches; small, 1.25 inches; stroke of piston, three inches; motor, alternating current, one-third horsepower; direct, .25 horsepower; revolutions, 150 a minute. Catalogue and price lists will be mailed upon request.

TAPS AND DIES.

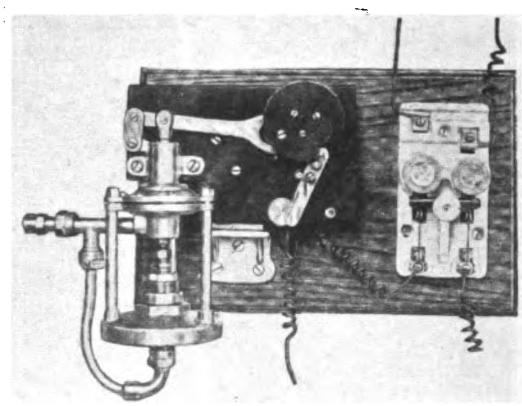
Taps and dies are broken in use and must be replaced from time to time. The American Tap & Die Company, Greenfield, Mass., is issuing a neat illustrated catalogue showing various forms and sizes of dies, reamers, screw plates, taps, tap wrenches, etc., which will be mailed to the trade free of charge upon application.

FOSTNACHT VALVE RESEATER.

The National Auto Specialty Company, Tama, Ind., is marketing the Fostnacht valve reseater, a tool designed especially for reseating and polishing valves with a minimum outlay of energy. The outfit comprises a large cutter, designed to fit all sizes of 45-degree valves and five sizes of cutters are constructed from 1.5 to 2.25 inches. The latter are made of a high grade carbon steel and they may be removed and resharpened.

VALVE GRINDING COMPOUND.

An efficient grinding paste, and one that costs but a few cents to make, is prepared by mixing No. 120 carborundum with oil. Badly pitted valves will yield to a treatment of this compound. It can be mixed as needed and should be employed sparingly as it cuts quickly. The best way is to place the carborundum in the cover of an old tin box with the oil separate. The powder is



Illustrating Automatic Switch Utilized with Champion Air Pump Outfit.

then worked into the lubricant in suitable quantities. Care must be taken not to use too much of the carborundum. After using this material the valves and their seats should be washed thoroughly with gasoline.

CORRESPONDENCE WITH THE READER.

Anti-Freezing Solution.

(27)—Am having considerable trouble with anti-freezing solutions heating up motor. The machine was an old pleasure car and the radiator has been soldered a number of times to stop leaks. I used denatured alcohol, but the solution boils very easily and the engine gets very hot. As the machine is stored in an unheated building I do not dare to try drawing off the water as a garage man told me that it would be impossible to drain off all the fluid. Isn't there some other kind of solution to employ that will not heat as easily as the alcohol?

A SUBSCRIBER.

Portland, Me., Feb. 18.

An alcohol solution boils at a lower temperature than water, depending upon the percentage of alcohol. A calcium chloride solution would be better, but is more troublesome to prepare. The fact that the cooler has been repaired several times would indicate that it is not performing its function properly and it should be thoroughly cleaned with a saturated solution of common washing soda. Dissolve as much as possible in water and fill the radiator. Run the motor for 10 or 15 minutes, after which drain off the fluid and replace with fresh water. Allow this to circulate, then remove and refill the cooler with the anti-freezing solution.

It would be an excellent plan to examine the water pipes and pump to ascertain if they be free from obstructions. Sometimes an old rubber pipe will deteriorate to such an extent that the inner layers will loosen, impeding the flow of fluid, although the exterior of the tube appears in good condition. The pump may be worn so that it does not deliver the proper amount of water to the cylinders. A rich mixture will cause heating and improper valve and ignition timing are also factors to be considered.

There are several anti-freezing solutions which are held not to evaporate or heat as easily as water, among which may be mentioned Lubro, which was described in a recent issue under the head of New Accessories.

Forms of Piston Rings.

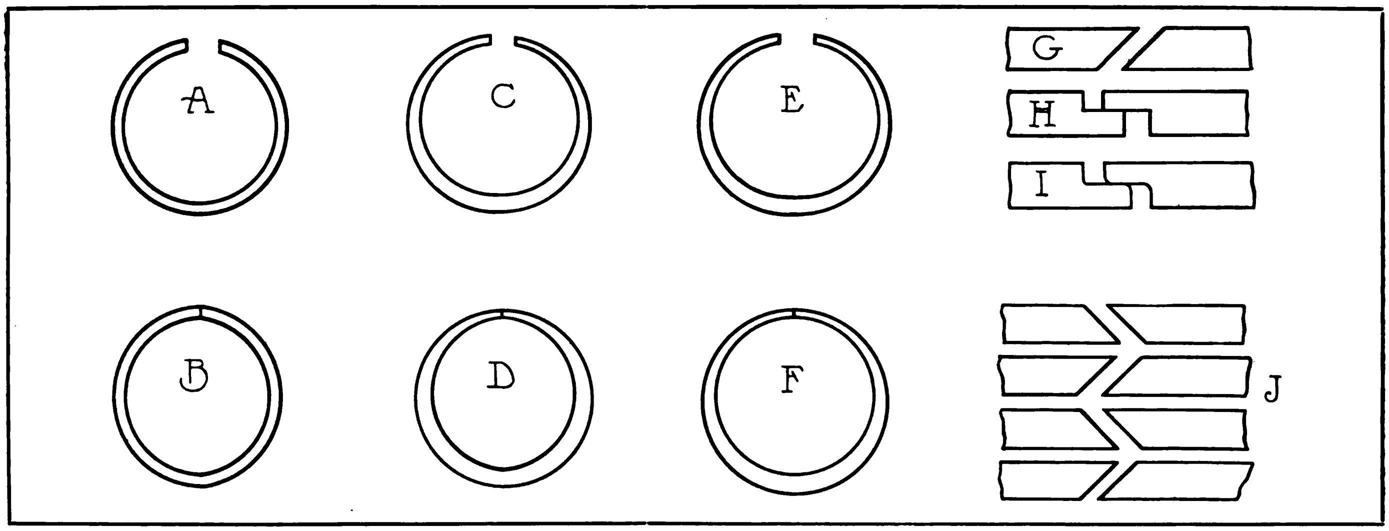
(28)—In reading descriptions of trucks and motors in your book I notice that piston rings are cut eccentric and concentric and that emphasis is laid upon the method of cutting and finishing. What is the difference between the two types and what is the advantage of either?

J. B. B.

Columbus, O., Feb. 14.

It is a generally accepted idea that if a ring be turned concentric inside and out and then split, the outward pressure on the cylinder walls, when the ring is closed and in its place, will not radiate from the centre. This is demonstrated in the accompanying illustration at A and B, showing the ring open and closed, respectively. It will be noted that with this design there are three bearing points, one either side of the split and at the lowest extremity of the circle.

Such a type would not be practical for service in a cylinder, so the ring is made thicker in the first instance and then turned to a true circle after being closed at the gap, thus giving a full bearing surface all around its circumference. Before doing this, however, some manufacturers make it a practise to turn out the inner periphery of the ring eccentric to the outer, in order to equalize the pressures at all points of the ring. This is depicted at C and D.



Illustrating Piston Ring Construction: A, Concentric Type, Open; B, Closed; C, Eccentric, Open; D, Same Closed; E and F, Eccentric Finished to True Circles Inside and Out; G, H and I, Showing Different Steps; J, Diagonally Cut Rings Arranged Oppositely.

A ring of the eccentric type is shown at E and F and costs but slightly more to manufacture than the type previously mentioned. It is turned to a perfectly true circle inside and out with the gap closed, the outer circle being eccentric to the inner. By referring to F it will be noted that not only are the pressures even on all parts of the ring, but less pressure is required to make it gas tight. It is held that there is less uneven wear of the cylinder walls, less heat developed and greater efficiency of the motor.

Relative to joining the rings, there are several methods, some of which are illustrated at G, H and I. That at G consists of a diagonal cut across the face. There is a tendency in this type to rotate in the opposite direction to that in which the lower diagonals point, and some make it a practise to cut every other ring in the opposite direction to its neighbor as shown at J.

RECENT MOTOR VEHICLE PATENTS

Walter Tire.

Benjamin Walter, Livermore, Penn., has been granted a patent for a resilient tire. It comprises the usual outer casing and has a plurality of inflated members completely filling the interior of the outer member. These members have flat abutting faces and are provided at corresponding points with the co-operating elements of a ball and socket joint.

Hart Resilient Tire.

Among the patents granted recently is that to Harry D. Hart, San Diego, Cal., for a resilient tire for vehicles. The material employed is a woven wire cable, this being coiled transversely of the rim of the wheel. A core having inner and outer grooves is fitted for receiving the loops of the coil, and grooved rims are provided, these fitting on the inner surfaces of the core and being adapted to secure the parts to the felloe of the wheel.

La Driere Wheel.

A patent has been granted to Joseph L. La Driere, Albuquerque, N. M., for a vehicle wheel. The hub is a combination member having an annular groove in its inner side and an outer section having a central recess in its outer side. The hub also has a circumferential groove with transverse ribs in its bottom, and a large number of teeth are provided on the sides of this groove. Transverse bolts are utilized for connecting the sections and their heads are disposed in the annular groove. The locking nuts are mounted on the outer ends of the bolts and are disposed in the central recess. An inflated tube surrounds the hub and is seated in the circumferential groove. This has an inflation tube in the outer end which is disposed in the central recess. An outer casing portion surrounds the hub and the inflated tube in such manner as to permit of vertical movement of the hub within said casing portion. Transverse ribs are arranged in radial alignment with the spaces between the teeth of the hub and have inwardly extending end portions on the ribs. The device includes an annular packing bearing against the inner side of the hub, and a closure plate detachably connected with the outer side of the casing portion.

Bordo Priming Device.

A patent for a gas engine attachment has been granted to Lambert J. Bordo, Hillside, Penn., which includes means for priming the cylinder of an engine. It comprises a valve casing which is screwed into the valve plug member or cylinder wall and is provided with a passage extending through it. A valve is incorporated and is so constructed that it may be moved by a handle and lever so as to provide communication between the cylinder and the outer air. Another movement of the lever closes the passage, but allows fuel or other fluid to be introduced into the cylinder through means of a cup attachment. A transparent diaphragm is employed to close the branch passage and by it the interior of the cylinder may be inspected. The device presents interesting features in that it may be employed to ascertain the color of the exhaust as well as to serve for a priming member.

Dion Safety Crank.

Among the devices patented recently for preventing injury to the operator when cranking the internal combustion engine is the safety crank invented by Francois Dion, Manchester, N. H. The engine shaft has an extension and integral clutch teeth which engage with similar teeth of a longitudinally movable starting crankshaft having a detachable extension which telescopes over the engine shaft extension. Means are provided to prevent the detachable member from being removed. A ratchet member is loosely mounted on the detachable portion and means are included to prevent backward rotation. The ratchet member has inclined teeth, these extending laterally, and co-operating teeth are fitted to the starting crankshaft with which those on the ratchet member engage when the clutch members are in engagement.

Erickson Spark Plug.

Frederick William Erickson, New York City, has patented a spark plug the shell of which is cylindrical in form and has a perforated lower end with inwardly bent sparking points. A supporting ledge is provided in the upper part of the shell and a perforated mica disc rests upon the ledge. The insulating post is also perforated and its lower end extends into the upper part of the shell. A collar is adapted to bear on the exterior of the post and upon the edge of the disc, securing the latter to the shell. A metal rod extends through the interior of the shell and the post, one end of which is separated from the sparking points by a gap, while the opposite end is provided with a screw thread and a nut.

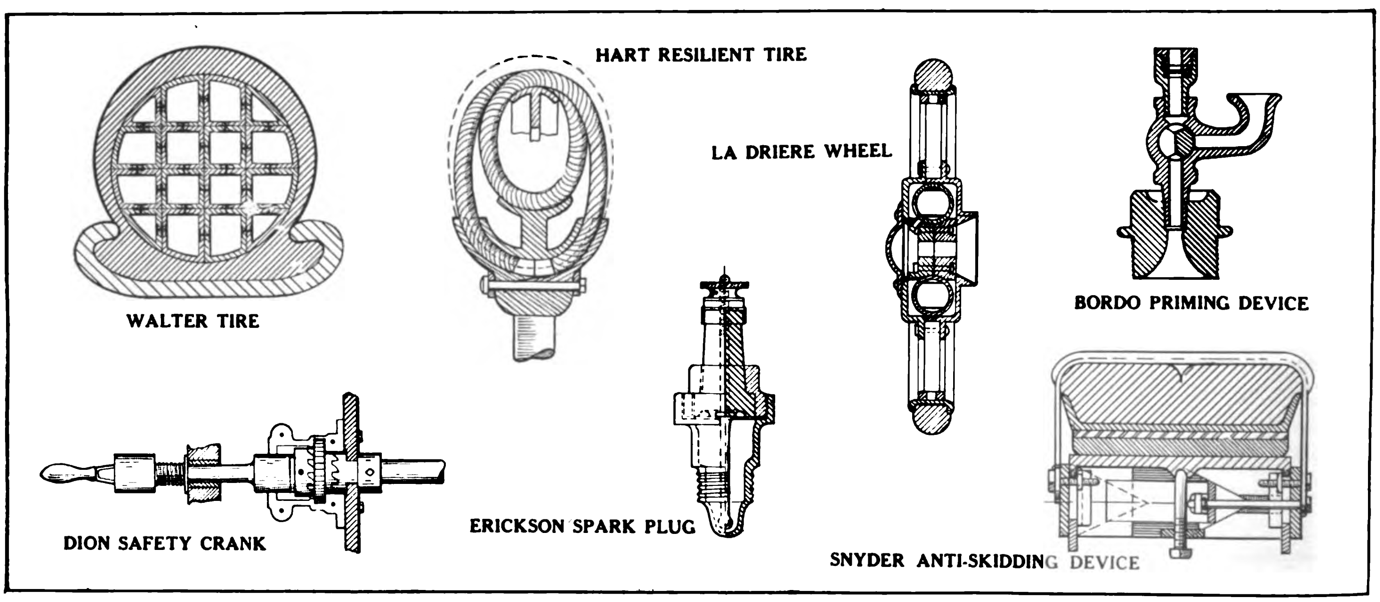
Snyder Anti-Skidding Device.

William H. Snyder, Ashbourne, Penn., has been granted a patent for an anti-skidding device applicable to solid tires. It comprises a band adapted to engage the tire, and a frame to which the band is connected. There is a second frame moveable with respect to the first, and both have cam faces thereon. Means also are provided for actuating an expander having cam faces adapted to engage those of the two frames. A resilient connection is incorporated between the expander and the actuating members.

Other Patents Gone to Issue.

Tire Mail, Joseph B. Duhring, Chestnut Hill, Penn. A tire mail comprising crossed strands of chain links, the links of one strand inclosing a single loop in the adjacent link of said strand and the superimposed link of a crossing strand.

Oil Can, Ralph A. Wakefield, Sacramento, Cal. The can is similar to those of conventional construction, but carries a spring actuated pin projecting from the bottom to the top of snout. By compressing the bottom of the oiler the pin is forced away from snout opening, allowing the lubricant to flow. Normally the spring retains the head member upon its seat, closing the aperture.

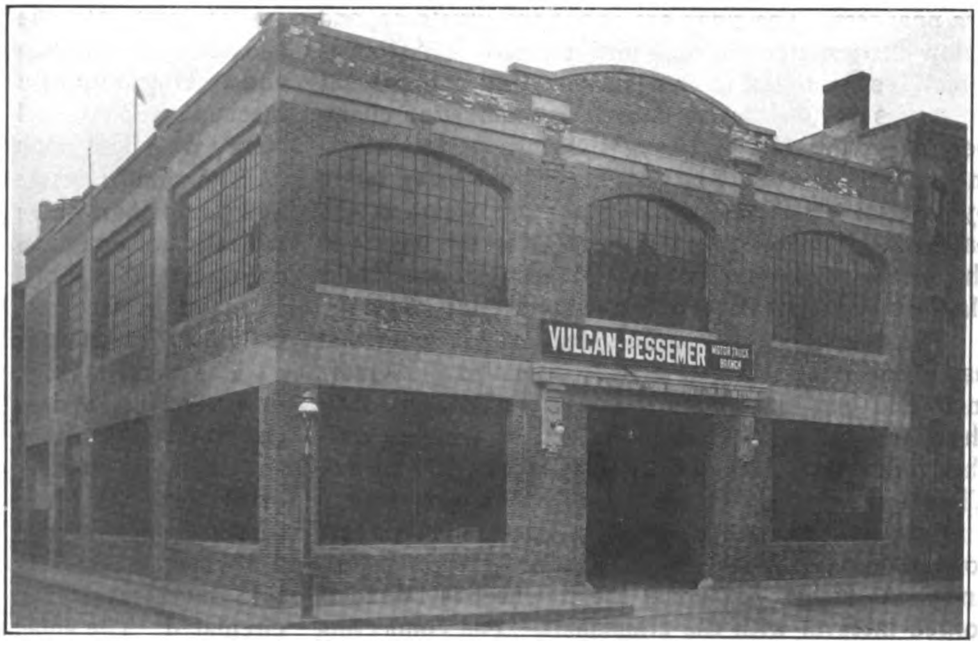


Illustrating Some of the More Recent Patents Applicable to the Commercial Vehicle.

THREE BESSEMER TRUCK MODELS FOR 1913.

THE Bessemer Motor Truck Company, Grove City, Penn., which placed in the market a 2000-pound wagon as its first product, now produces three sizes of machines, these being of 1500, 2000 and 3000 pounds capacity. The policy of the company as first established was to build a single type of vehicle, but after carefully prospecting the market and ascertaining the requirements for what may be regarded as the light and quick delivery service, it was decided that it would be best to have types that might be utilized for specific purposes rather than to expect that the single size would serve those whose needs were general. The two later machines are built to practically the same design and there is a similarity throughout, but the smallest chassis differs from the others.

The Bessemer delivery wagons have been designed with a view of securing all the qualities that make for reliability and endurance, and insure a minimum of labor and expense in care and maintenance, for it is necessary for the owner of a motor delivery vehicle to have its service constantly, and withdrawal for any cause means the loss of its use for the time being and the added cost of a substitute. In the design of the machines great care was given to accessibility and simplicity, that every moving part could be examined and lubricated and adjusted whenever necessary, and that whatever repair might be needed could be made without removal of more than a single assembly.



The Service Station of the Bessemer-Vulcan Motor Truck Branch at 58-62 Church Street, Boston, Maintained for the Benefit of New England Users of Bessemer and Vulcan Machines.

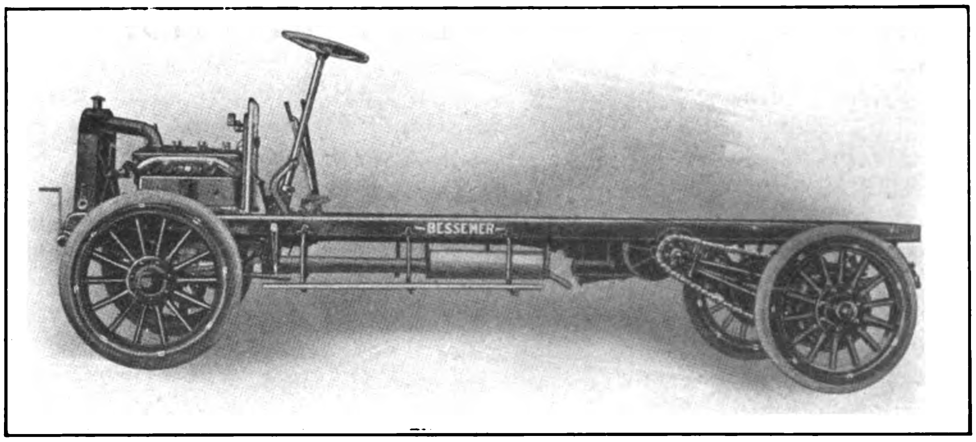
The hooded motor was decided on because it was believed that this type is the easiest to examine and work upon, all parts being exposed by lifting the hood, and a great deal of the attention needed can be given without removal of any of the auxiliaries. The chassis length is such that there is abundant loading space behind the seat for the driver, and the proportions were decided with the purpose of equalizing the tire load and minimizing the tire expense. The construction of all three designs has been with an ample margin of safety and every component has been determined to endure a stress much in excess of the normal requirements, and the choice of special materials has been made to afford such strength with a minimum weight of metal.

For the purpose of description the 3000-pound chassis will be considered, and this will give the general characteristics of design and construction. The 2000-pound machine differs but little aside from proportions of the components. The 1500-pound chassis has a smaller motor and there are some changes in the design.

The motor is a four-cylinder, water-cooled, vertical, L-head type, with bore of 3.75 inches and stroke of 5.25 inches, with the cylinder cast en bloc. While the S. A. E. rating is 22.5 horsepower, it is claimed for this engine that it will develop approximately 42 horsepower at 1500 revolutions. The cylinder block is cast from a special grade of reverberatory air furnace iron, with extremely wide and heavy base flanges and with a large water jacket head. The water spaces are large and the casting is so made that the passages are thoroughly cleared and there is a positive circulation of the water. After the rough boring the blocks are aged to eliminate distortion from casting strains, and are then reamed and ground to size. Before and after machining the blocks are subjected to water pressure tests to develop leaks and possible defects and by a special process the water jackets are cleared. The water jacket head extends the entire length of the block and the head or cover plate is retained by a series of cap screws.

The crankcase is an aluminum alloy casting that is in two sections, the upper half carrying the three main bearings. The lower section is divided horizontally by a web, above which is the oil basin carrying the pits in which the lubricant is collected for the splash lubrication, and under which is the oil reservoir. This half of the case may be removed without loosening the main bearings of the engine. The arms of the motor are cast integral with the upper section.

The extra length pistons are cast of the same metal as the cylinder block and after turning are ground to size. Each piston is channelled for four rings that are



Side View of a Bessemer 3000 Pounds Capacity Delivery Wagon Chassis, a Construction Noticeable for the Long Loading Space with Reference to Wheelbase.

of the split eccentric type, ground on the edges and the faces to accurate fit. The rings are specially machined to relieve all casting strains and when fitted the motors are run under separate power to insure the rings having perfect bearing in the cylinders before the final test. The rings are above the wristpins, and below the wristpins in each piston are five oil grooves which insure an equal distribution of oil and prevent an excess of lubricant reaching the combustion chamber. Extreme care is taken to secure perfect alignment of the wristpin bearings, the pistons being bored by special machines. All pistons are weighed and balanced. The wristpin bearings are in the bosses in the piston walls and the wristpins are of steel tube clamped in the small ends of the connecting rods.

The crankshaft is a carbon steel drop forging that has a tensile strength of 90,000 pounds to the square inch, and has three main bearings, these being 2.75, three and four inches respectively from front to rear, this giving a total main bearing length of 9.75 inches. The diameter is 1.75 inches. The shaft is heat treated and carefully ground to size. Special flanges are formed to prevent end thrust to afford greater endurance. A flange to which the flywheel is bolted is forged integral with the crankshaft. The connecting rods are drop forged I sections of carbon steel, and the wristpin and crankpin ends are bored and reamed on special machines to secure positive alignment. The crankpin bearings are clamped in the ends of the rods by special nickel steel bolts that are secured by a locking device.

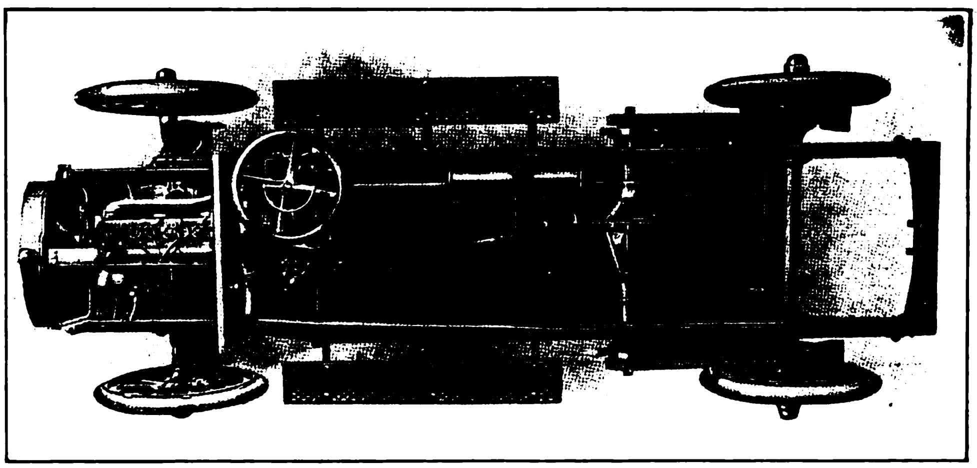
There is a single camshaft that is drop forged from low carbon steel with the cams integral, and after the shaft has been turned and the cams roughly machined it is heat treated, and then the cams are finish ground. This insures extremely accurate cams.

All the crankshaft, camshaft and connecting rod bearings are of nickel babbitt of high grade and the connecting rod and crankshaft bearings are held by brass retaining screws. All bearings are carefully fitted, expanded by special arbors, reamed and scraped to fit. The connecting rod bearing adjustment is obtained by steel shims. The camshaft is so fitted that it may be removed by taking off the gearcase cover.

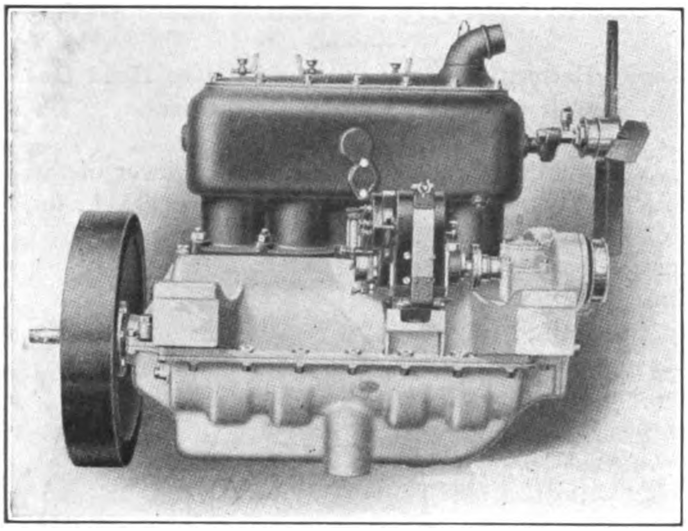
The valve ports are two inches diameter and the valves have nickel steel heads and carbon steel stems, electrically welded. The stems move in cast iron guides, removable when worn. The valve clearance is sufficient to insure complete scavenging of the cylinders and full charges of fuel gas. The valve stem ends are hardened to resist wear. The tappet rods are a mushroom type that operate in cast iron guides inset into the base flange. These rods are hardened and at the upper ends are adjusting screws and locking nuts to compensate for wear. The valve mechanism is covered with plates fitting into end and centre webs and retained by wing nuts.

The timing gearset includes one crank, cam, idler and pump shaft gears, which have wide faces and are helically cut on automatic hobbing machines to obtain accuracy. The gears are shaped with particular care to maintain accurate centres. The gears are practically noiseless in operation.

The motor is lubricated by a pair of plunger pumps driven by eccentrics from the camshaft which force the oil through tubing to the rear main bearing and to the timing gearcase. The excess oil drains to the base of the case and into the pits into which the big ends of the connecting rods sweep. The oil is maintained at a constant level in these pits and the overflow runs into the reservoir, where it is filtered before it is again circulated. The splash lubricates the centre main and the connecting rod bearings, the cams, tappets and guides, wristpins, pistons and cylinders, and the camshaft bearings are lubricated by a flow from pockets



Top View of a Bessemer Delivery Wagon Chassis of 3000 Pounds Capacity, Showing the Compact Power Plant and the Unit Assembly of the Gearset Case and Jackshaft Housing.



The Magneto Side of the Continental Motor Used for the 3000 and 2000-Pound Bessemer Chassis.

which are cast in the wall of the crankcase.

The motor is cooled by a thermo-syphon circulation of water through the cylinders, there being large inlet and outlet manifolds and a channel in the cover plate of the cylinder head affords a direct movement of the liquid from the rear across the heads of the forward cylinders. The radiator is large and this is cooled by a fan mounted on the forward end of the block on a bracket that is adjustable to give the necessary tension to the flat belt. This belt is driven from a pulley carried on a forward extension of the magneto drive shaft. The exhaust and intake manifolds are bolted to the cylinder block well above the valves, so that these may be worked on without removing the manifolds.

The carburetor is an automatic float feed type and the ignition is by a high-tension Eisemann magneto.

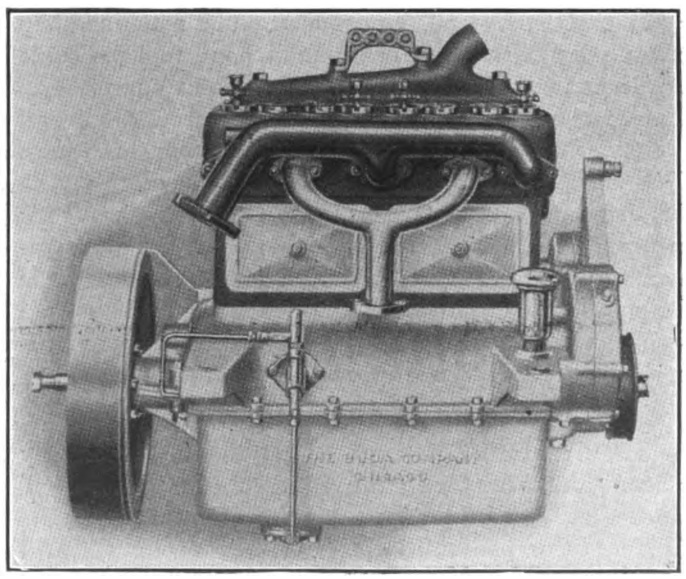
There are two centre cross frame members. The forward member carries the bracket in which is mounted the driving shaft and on this member is also the quadrant in which the gearset and the emergency brake levers are mounted. Forward of the bracket is the clutch shaft, on which is the cone clutch, faced with an anti-friction material. The cone is a spider with wide arms, and the construction, though light, is very enduring. The spring tension can be adjusted from the outside and the entire clutch can be removed by loosening three bolts. On the frame cross member are the clutch pedal and emergency brake shafts and the foot brake lever. The control lever quadrant is in the centre and this may be taken out by removing four bolts.

The second cross frame member carries a bracket that supports the forward end of the transmission gearset. The gearset case is cast integral with the jackshaft housing. Between the two cross members is the driving shaft, with a universal joint at either end. The gearset is a sliding gear selective type, giving three forward speed ratios and reverse, and the shafts and gears are of nickel steel, heat treated. The gears have very wide faces and the shafts are mounted on imported annular ball bearings. The jackshaft housing is cast steel and the construction is full floating type with imported annular ball bearings. The differential is a bevel gear design.

The frame is a heavy pressed steel channel section and it has four cross members. This is carried on semi-elliptic springs forward and a semi-elliptic platform spring at the rear, the platform having a cross member mounted in a block of unusual size. The shackles are very heavy and should endure a great length of time. The forward axle is an I section of Timken design, with ample steering knuckles, with the pivots and spindles fitted with Timken roller bearings. The rear axle is a rectangular steel drop forging with big spindles and Timken roller bearings. The radius rods are fitted so as to have a vertical movement with relation to the rear axle, and a transverse movement at the connection at the jackshaft hanger. The radius rods are adjustable with eccentrics and vernier adjustments that are bolted at any desired relation. The wheels are 34 inches diameter and are shod with 3.5-inch tires forward and four-inch tires rear. The control is by the usual levers and pedals. The service brake is internal expanding in a drum 14.75 inches diameter, having a three-inch face, and the emergency brake is external contracting on the same drums. The brake bands are faced with Raybestos and cannot be affected by any condition that might result from service.

The 2000-pound chassis is slightly smaller in its general proportions than the 3000-pound machine, but the principal difference is in the length of the frame and the size of the axles and wheels, the wheel spokes being lighter and the tires being three-inch forward and 3.5-inch rear. The wheelbase of the 3000-pound chassis is 130 inches and of the 2000-pound chassis 120 inches, and the normal loading space is 118 inches in the larger machine and 102 inches in the smaller.

The 1500-pound chassis has as a power plant a Buda motor with bore of 3.75 inches and stroke of 4.5 inches, which is rated at 22.5 horsepower by the S. A. E. formula. It is claimed by the maker to develop 25



The Valve Side of the Buda Motor Installed in the 1500-Pound Bessemer Chassis.

horsepower, and this is conservative. This motor is admirably designed and it is with the cylinders cast en bloc, with a large water jacket plate covering the top of the block. The motor is the L-head type with the valves at the right side. The crankcase is made in upper and lower sections, the upper carrying the main bearings, and the lower forming the pool for the splash lubrication. Below this is the oil reservoir. The motor is cooled by a thermo-syphon circulation of water through a radiator, and radiation is promoted by a fan driven by a flat belt from a pulley on the forward extension of the crankshaft. The lubrication is a combination system, the oil being pumped through a sight gauge on the motor and then to the oil pool in the base of the crankcase, where it is distributed by splash. The valves are enclosed by plates and all of the working mechanism is fully protected. The ignition is by an Eisemann high-tension magneto. The other details are practically the same, though the transmission gearset shafts are mounted on Hyatt roller bearings. The axles and wheels are somewhat smaller and the tires are 34 by 2.5 inches forward and 35 by three inches rear. The wheelbase is 108 inches and the loading space is 90 inches. The control members are identical and the brakes are internal expanding and external contracting on drums 13.5 inches diameter and 2.75 inches width. All of these machines are fitted with bodies to meet the requirements of the purchasers, and a considerable number of standard designs are always in stock, so that delivery may be made quickly.

The owners of Bessemer wagons in Boston and vicinity specifically, and throughout New England, generally, have the service that is afforded by a very complete station at 58 Church street, Boston, which is known as the Vulcan-Bessemer Motor Truck Branch. The building was completed late last year and was occupied in November. It is ideal in facilities and equipment and has space to store about 40 machines of differing sizes. While the attention given to those who desire that their machines have usual garage care is thorough and to a high standard, the provision made for service maintenance is with a view of meeting every emergency and requirement. The machine shop is equipped with every machine or hand tool desirable or necessary, and the stock of parts is as complete as that at the factories. The workmen are skilled and are experienced with Bessemer and Vulcan machines. This station is never closed and its resources may be depended upon as at all times available. The branch is in charge of Robert G. Howard, New England manager for the Bessemer Motor Truck Company and the Driggs-Seabury Ordnance Company, maker of Vulcan trucks, who is widely known and who has much experience with service station administration.

The Cranford Company, Brooklyn, N. Y., recently placed an order with the R. & L. Company, New York City, distributor of Garford trucks, made by the Garford Company, Elyria, O., for seven Garford trucks, to be used in asphalt paving work.

HOLLAND WITH ANDERSON COMPANY.

Storage Battery Expert Leaves Edison to Head Detroit Electric Research Department.

Walter E. Holland, who was chief engineer of the Edison Storage Battery Company, Orange, N. J., for a considerable period, and is one of the recognized storage battery engineers of the country, has retired from that position to become head of the research department of the Anderson Electric Car Company, Detroit, Mich. Mr. Holland associated himself with the Edison organization in 1902 and did a great deal of experimental and research work with acid and with the nickel-iron accumulator, known as the Edison battery, and his experience was of extreme value to him when he later on became a member of Mr. Edison's personal staff and engaged in research necessary in connection with electrical development.

Walter E. Holland, Head of Anderson Electrical Research Department.

Mr. Holland has perfected a number of important improvements in storage batteries and is regarded as an authority. He was appointed chief engineer in January, 1911, and continued as such until he resigned. He is widely known among electrical engineers and some of the papers he has presented to engineering organizations have been translated into several languages.

TRACTION PLOWS AND TRUCKS.

Pacific Metal Products Company to Enter Field in New Building at Torrance, Cal.

The impression has been gained by many persons that the new factory at Torrance, Cal., being erected at a cost of $100,000 for the manufacture of traction plows and motor trucks, is to be used by the Union Tool Company of that place, near whose plant the new building is being built.

The Pacific Metal Products Company, states, however, that this is erroneous. This concern is already operating a $100,000 plant in the production of its metal goods, and the new building is being erected for the convenience of the company in manufacturing its new line of plows and trucks.

SAURER 'BUS SERVICE.

Alpine Motor Company of Pittsburg Adopts Machine with Capacity for Thirty.

A large motor car, capable of seating 30 persons and modelled on the order of an ordinary trolley car, has been put in service by the Alpine Motor Company of Pittsburg, Penn. The machine is a five-ton Saurer chassis, made by the International Motor Company, the motor being 40 horsepower. The vehicle weighs 10,000 pounds and is capable of 25 miles an hour for any time desired.

The interior of the car is furnished with all the modern requirements for comfortable transportation and the riding of the car over rough streets is said to be easier to the passenger than in an ordinary trolley car. The machine is equipped with emergency, air and service brakes and is driven from a small compartment in the front end, separated by a glass partition from the passengers. Twenty gallons of gasoline, ample for a day's run, can be carried in a tank with which it is equipped.

NEW FACTORY FOR UNIVERSAL.

Company Now Incorporated Under Laws of Delaware with Increased Capital.

Announcement has been made by Fred K. Parke, secretary, treasurer and general manager of the Universal Motor Truck Company, Detroit, maker of Universal trucks, that the company has been incorporated under the laws of Delaware, the capital stock being $1,200,000, of which $500,000 is preferred stock and $700,000 common. All stock has been sold and work will be begun at once on the erection of a factory quite as large as the present plant.

The new building will adjoin the old one, the company having owned the entire square block of property since its organization. It will cost $250,000 without the machinery. According to Mr. Parke the Universal company will soon be one of the largest concerns in the world producing commercial motor vehicles and as the business increases other additions will be made.

ANOTHER BUILDING FOR SANFORD.

Increasing Demand for the Product Necessitates Plans for Doubling Present Output.

The Sanford Motor Truck Company, Syracuse, N. Y., maker of Sanford trucks, is increasing its facilities for greater output and has purchased of the Syracuse Savings Bank the three-story building at the end of West Fayette street. The purchase price is not named. At least 300 trucks, it is expected, will be made this year, more than doubling the output.

While the company at present has only about 50 men on its payroll, it is anticipated that between 200 and 300 will be employed before the end of the year. Last summer the corporation's capital stock was increased from $25,000 to $50,000 for the purpose of providing the additional facilities, made necessary by the increasing demand for trucks. J. Frank Durston is president of the concern and F. F. Sanford is secretary and treasurer.

SATISFIELD WITH POPE-HARTFORD.

Newark Coal Dealer Much Pleased with Initial Installation of Dumping Body.

Joseph H. Lucking, coal dealer of Newark, N. J., recently purchased a Pope-Hartford five-ton chassis, equipped with self-discharging body. The truck has a capacity of six tons and notwithstanding the adverse street conditions since its installation, it has delivered from 45 to 50 tons of coal daily with an average haul of five miles a load.

Mr. Lucking states that the truck has thus far exceeded his expectations. Delivery is made from the right side. The body is elevated and the coal is discharged almost noiselessly on account of the steady flow. The entire six tons can thus be unloaded in less than two minutes. Mr. Lucking has ordered a three-ton truck of similar design to be delivered in a month and he will dispose of his horses as soon as he can replace them with motor equipment.

G. V. MACHINES IN THE PHILIPPINES.

First Installations Have Demonstrated Their Value and Additional Orders Are Now Being Filled.

The first electric wagon used in the Philippine Islands was a General Vehicle machine, which was utilized about Manila. The highways about the islands at best can be regarded as poor roads, and generally they are cart paths, but in and about the principal cities there are very good streets and in some instances ways good enough to be classed as boulevards. The first electric vehicle was a ton capacity, and this was used practically in the city of Manila.

The United States War Department then purchased several machines and has added to that number until it now has 19 in service, all of which are employed in the haulage of supplies, etc., for it is a work of no small proportions to regularly distribute these. Four machines were bought by business houses for private use, and these were used with the same satisfaction as those in government service.

The company is now producing 16 other machines of differing capacities, which will be sent to the Philippines early in the present year, which will increase the total of General Vehicle wagons and trucks in the islands to 39. The utility of electric machines has been so positively demonstrated that it is believed that the number will be considerably augmented during the present year.

DEVELOPING RAILROAD BUSINESS.

South African Railways to Adopt Motor Road Transport in Lieu of Branch Lines.

According to information from South Africa, the general manager of the South African Railways has developed a new plan for developing business in the outlying sections, where the demand for transportation is held to be insufficient to warrant the construction of branch railroad lines at present. Several such districts are said to be rich in productiveness, were it possible for them to be placed in regular communication with railway service.

The plan considers the establishment of a motor road transport operating two types of vehicles, one for passengers, parcels and mails, and the other for heavier freight, with a speed of from 12 to 20 miles an hour. A telephone will parallel the road and the whole service, as far as possible, will be conducted in accordance with railway methods. In each case it is proposed to build a branch line as soon as the extent of the traffic is sufficient to justify such action.

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The MOTOR TRUCK

Devoted to Motor Driven Business Vehicles of All Classes.

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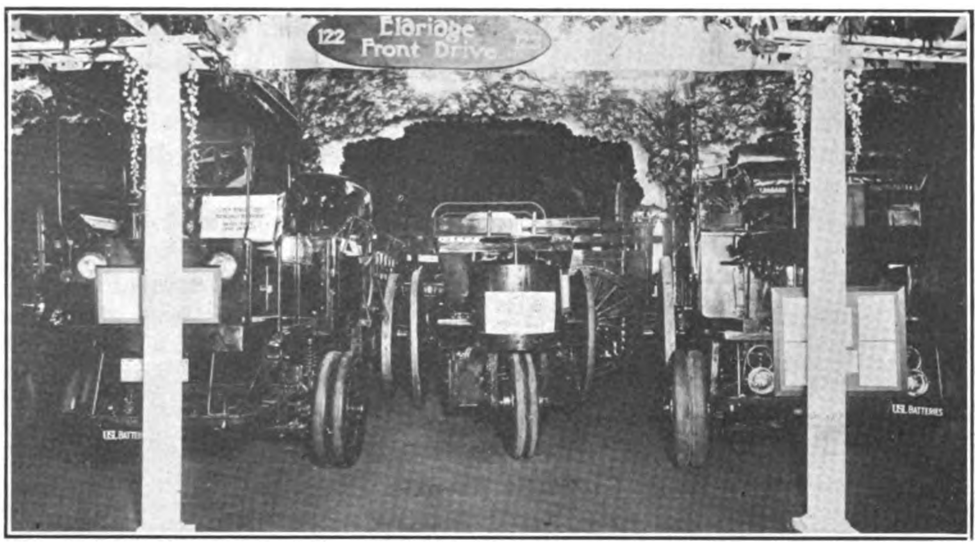
BIG BUSINESS AT BOSTON'S TRUCK SHOW.

Directors Vote Before the Close to Hold Similar Exhibition in 1914---Two New Makes of Both Electric and Gasoline Machines Are Shown, with Many Seen for First Time in New England---Fine Display of Body Designs.

MEASURED by the volume of business transacted and the interest manifested in power vehicles, the second exclusive exhibition of the Boston Commercial Motor Vehicle Association, held at Mechanics' building, in that city, March 19-26 inclusive, was without question the most productive of the service wagon shows held during 1913. If one were to judge from long range and consider as principal factors the number of exhibitors of machines, or even the aggregate of vehicles displayed, there might be issue taken with this statement, but the best judgment is that of the exhibitors, many of whom are members of the association, and so satisfied were they with the results that before the conclusion of the show it was voted to have a similar exhibition in 1914.

While the executives of the national organizations that have directed the exhibitions in New York and Chicago have decided to discontinue the exclusive shows of wagons and trucks in those cities, the Boston association has voted unanimously to continue, and with no change in policy other than to reduce the interval between it and the pleasure car exhibit to a single week day. That is, the Sunday and Monday after the close of the pleasure vehicle show will be given over to removal of the exhibits and the installation of the power wagons in the stands. This will permit the closing of the exposition on Saturday evening, and give five full days, instead of six full days and seven evenings, with a Sunday intervening.

The principal reason for this change is to minimize the demands made upon the exhibitors who have their local business as well as show interests to give attention to, and who have found that in addition to the shows the necessary preparation for and the accumulation of work during their progress makes it imperative that the exhibits be confined to two weeks. There was no question as to the productiveness of the show from many viewpoints, and the results will undoubtedly be realized in very large measure by all exhibitors who have representatives in the section from which the visitors were attracted.



The Eldridge Front Wheel Electric Driven Machines, Showing the Single Wheel Dump Cart of Two Tons Capacity, an Entirely New Production.

If there is to be a criticism of the service wagon display that is to follow an exhibition of pleasure vehicles, it is in the fact that it is impossible in the short time to so arrange the exhibition spaces as to give to the exhibitors the floor area often desired. Where both pleasure cars and service machines are made by the same concern, what might be sufficient to show the passenger types might be entirely inadequate to give a satisfactory display of the freight wagons, and where the stands are primarily allotted for the first display, and they cannot well be greatly changed for the second, the only possibility of

The Display of the Knox Automobile Company, Which Was Principally Made Up of Fire Apparatus and Knox-Martin Tractors and Equipment.

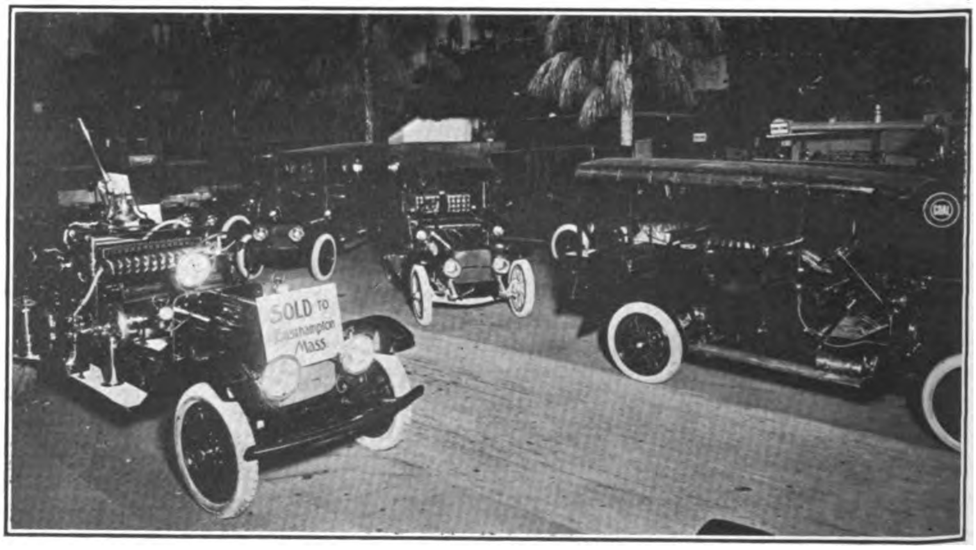
The Boston show for 1913 was in every way a success. There were in all 57 different makes of machines shown, and there were in all 219 chassis, of which about 85 per cent. were equipped with bodies. It will be seen that while there were less makes seen than at either New York or Chicago, it was the largest exhibition ever held under one roof, and this was a decided advantage from the viewpoint of the exhibitors, for where time is limited it was possible for a visitor to see every type he cared to and he had the opportunity for comparison without leaving the building.

If there was one thing more than another impressed upon the observer it was the manner in which concerns that are investigating the possibilities of motor vehicle equipment study the machines in the market. While it would be practical to examine the machine in the salesrooms of the agents and branches at leisure, many firms sent to the Boston show the best engineers or mechanics in their employ with instructions to see all vehicles that might be suitable for the requirements and make special report on them. This necessitated the systematic examination of different vehicles of certain types, and in some instances these men gave several days to the investigations. It would not have been possible to have gathered the same detail or reached the men capable of giving the information in a very much longer period. It is absolutely impossible to reach any conclusion as to the business that was developed in this manner, but it is certain enough that when concerns take the care to obtain expert knowledge, or at least the judgment of men who may be depended upon, it is not from idle curiosity.

insuring a sufficient space for the second is by taking the desired area for it for both shows.

To do this means perhaps a larger expense than was intended or desired, or this prospect may mean the reduction of the space for the second show at a considerable inconvenience. As the space is generally applied for months ahead of the show there is small probability of making exchange in the event of a determination to forego display. It is impossible to have the stands without demarcation, and to make a material change would entail expense for the management. Regarded from any point of view it is not feasible to arrange for two successive shows, each of a different character, to obtain the same results were each exhibitor free to select the space desired, as in two separate exhibitions. Not only this, the exhibitor showing at both displays is ordinarily considered before the one desiring but one stand, and this sometimes limits the space that is available for those who can exhibit only at the second.

While these conditions were experienced to some extent in Boston, there was by no means the same results as in New York and Chicago, for in this the members of the association are entitled to whatever space may be desired, and no stands are allotted to non-members until members have first had opportunity to make application. The members of the national association have the first choice without reference to the agencies or branches in New York and Chicago, and after these applications have been provided for the others are considered. It will be understood that the Boston association members share the profits or assume the loss, and with the other shows the national body is the gainer or the loser.



A Section of the White Exhibit, Showing a Combination Hose and Chemical Wagon of Unusual Design That Attracted Much Attention.

The Stand of the Pierce-Arrow Motor Car Company, Where Was Shown the Well Known Worm Driven Machines, the Largest of This Type Exhibited.

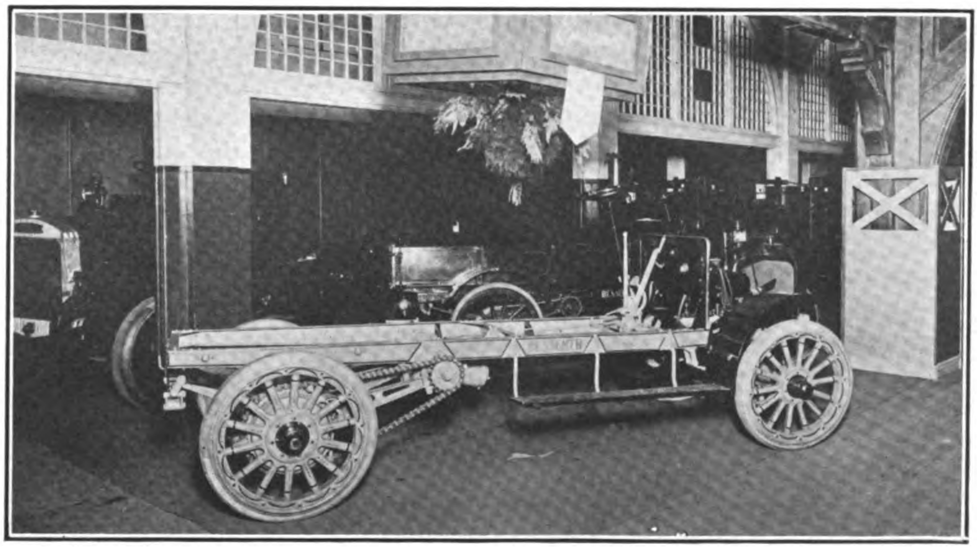
Another fact equally impressed upon the observer was that many firms that have motor vehicle equipment are desirous of obtaining all the information possible of machines that meet their requirements, because additional purchases are contemplated, and buying is governed by first hand knowledge. That is, concerns that have perhaps all the vehicles that will be used the present season believe it well to have precise detail of the machines that would be suited to their purposes, with a view of economizing time and accurately judging all from which choice can be made. Motor wagons are bought by the best measure of value the business man may have, and quality and utility are two elements that are given consideration.

There is no place where the information desired by a man who wants motor vehicles can obtain it as readily or as economically as at a show, which application is made to mechanical detail and construction, and the majority of buyers are willing, when dealing with a manufacturer of reputation or his representative, to accept statements as to materials and to judge construction, design and workmanship by the machine. But what is very often an unknown quantity is the character of service that will be afforded, or perhaps the assurance of co-operation in the maintenance and upkeep of the vehicle. This is a decidedly important factor with many buyers, and it is not an exaggeration of fact to assume that it will become even more potent in its influence.

Considering all qualities and values equal there is no doubt whatever that the character of the service afforded the owners of vehicles will be a very important reason for selection, and when both quality and service are considered it will be understood that nothing but actual worth and satisfying attention will meet the requirements of the day. The man who is making an investment in service wagons is just as desirous of making dividends upon the money it represents as in any department of his business, and buying is not influenced by sentiment or fancy. In other words the experience with the Boston show demonstrated that quality and service are first, and while the former can be ascertained from the vehicle, the latter must be learned from observation and from the experience of others.

The Boston exhibits were in a number of instances machines that had been shown at New York, Chicago and elsewhere, but a considerable number, and this was a very wise character of display, were machines with body equipment built to meet the requirements of different service that were sold and were to be delivered directly after the exhibition. The showing of the vehicles selected and ready for the work they were to do was not without its influence with those in similar lines of business seeking information. There were, of course, many bodies that might be regarded as standard in type, but of these a large number were built to specifications for certain work, and proportioned with reference to the chassis design, and examination of these afforded those desiring it exact knowledge of specialized vehicles.

There were not as many heavy trucks seen as at some of the other shows, for there was apparently a belief that the greatest demand is for the light and fast delivery vehicles, and there were comparatively few novelties. The showing of quick unloading bodies was very good, but the majority of those seen had been



The Bessemer Delivery Wagons and the Vulcan Trucks, the Last a New Vehicle, Which Were Noticeable for the Constructional Features.

shown at previous exhibitions. This does not mean that there was less interest in such equipment, but it does mean that in several instances power and manual hoists for dumping bodies were rejected for bodies that were specially built for Boston service. There were several bodies designed for lumber haulage, and of these one was seen at New York and Chicago, but the others were adaptations of well known constructions and were not new.

The exhibition was made up of 219 chassis, of which about 85 per cent. were fitted with bodies, and there were in several instances displays of parts or complete group assemblies of components, but with rare exceptions it was not believed necessary to have the elaborate showing of chassis members, once a feature of every vehicle show. Unless there was unusual construction the assembled chassis was regarded as sufficient. For those who really desired to give attention to detail of chassis construction the full body equipment was more or less or an inconvenience. One exhibitor solved this problem by showing chassis from which the bodies had been removed and were shown beside them, sufficiently elevated so they could be examined conveniently.

A Glimpse Along the Main Aisle in Machinery Hall, Showing the Stand of the General Vehicle Company, the Largest of the Kind in the Exhibition.

There were in all 57 different exhibits and 58 different makes of machines, the General Motors Truck Company showing both gasoline and electric vehicles. The exhibitors of gasoline wagons and trucks numbered 49, the electric displays were eight in number, and there was one exhibit of steam machines. The makes shown were as follows: Gasoline, Adams, Alco, Atterbury, Autocar, Bessemer, Best, Brown, Buick, Chase, Decatur, Federal, Flint, Garford, G. M. C., Gramm, Hupmobile, I. H. C., Jeffery, Kelly, Knox, Koehler, Lauth-Juergens, Lippard-Stewart, Little Giant, Locomobile, Maccarr, Mais, Marmon, Mercury, Overland, Packard, Peerless, Pierce-Arrow, Pope-Hartford, Reo, Sanford, Selden, Smith-Milwaukee, Sowers, Speedwell, Standard, Stewart, Sullivan, Universal, Velie, Victor, Vulcan, White and Willys; electric, Atlantic, Buffalo, Couple-Gear, Edison, Eldridge, G. M. C., G. V., Waverley; steam, Stanley.

The gasoline vehicles numbered 191, the electric 23 and the steam five. The largest number of machines shown by any one maker was 26, these being Packards, and the next in point of number was the White, of which 16 were displayed. The Autocar stand contained 10 wagons, and the Kelly and the General Vehicle exhibits were of eight each. The Lauth-Juergens, the I. H. C., the G. M. C., the Garford and the Knox showed six machines each; the Alco, Stanley, Stewart, Peerless, Lippard-Stewart and Pierce-Arrow five each; the Pope-Hartford, Brown, Federal, Velie and Eldridge four each; the Reo, Universal, Koehler, Selden, Bessemer, Sanford, Mercury, Atterbury, Chase, Decatur, Locomobile and Speedwell three each; the Standard, Waverley, Adams, Little Giant, Jeffery, Victor, Vulcan, Sullivan, Buick, Edison and Couple-Gear two each, and the Mais, Gramm, Willys, Overland, Hupmobile, Flint, Best, Buffalo, Atlantic, Marmon, Sowers, Smith-Milwaukee and Maccarr one each.

The machines that were shown for the first time in Boston included the Adams, Best, Brown, Buick, Flint, Hupmobile, Jeffery, Lippard-Stewart, Little Giant, Marmon, Mercury, Overland, Sanford, Selden, Smith-Milwaukee, Sowers, Standard, Stewart, Sullivan, Universal, Vulcan and Willys, in the gasoline vehicles, and the Buffalo and Edison in the electrics. The Atlantic trucks were shown for the first time in Boston at the electrical exhibition last autumn. The constructions seen for the first time were the Sowers, a Boston-made machine; the Edison, which is built at Lawrence, Mass., and the Marmon, while a new type of vehicle with familiar propelling power is the front-wheel driven Eldridge dump cart.

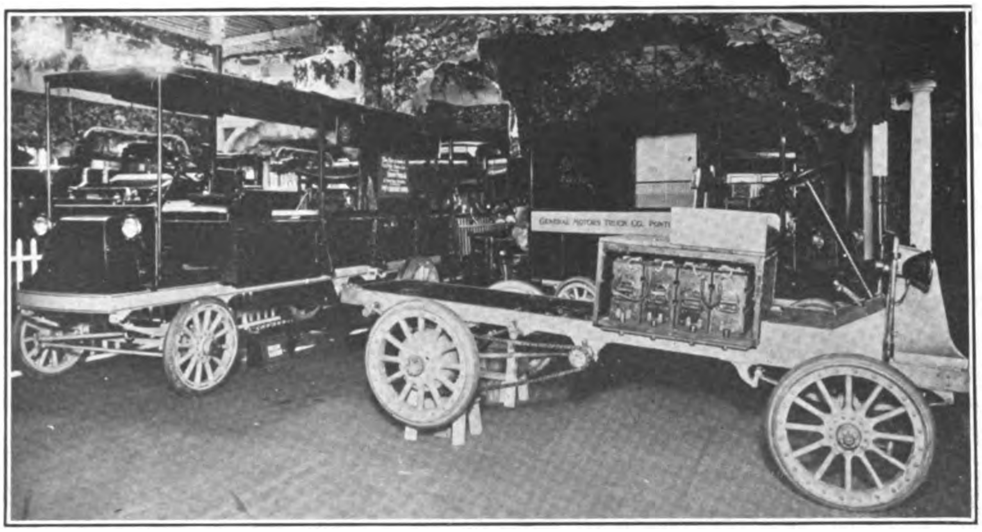
Considering the machines having initial exhibition in Boston the entire number shown aside from the Standard, Vulcan and the Smith-Milwaukee were what would be included in the light classification, no one exceeding two tons capacity, and the majority ranging from 1000 to 3000 pounds. Several makes are produced in larger sizes than were shown. There appeared to be a prevailing opinion among exhibitors that there is a more productive market for the lighter vehicles, from the fact that so many of these types were seen.

The exhibits including quick discharging bodies for heavy loads were those of the Alco, Garford, G. M. C., Knox, Locomobile, Peerless, Packard, Pierce-Arrow, Speedwell, Velie and White, in the gasoline machines, and the Eldridge in the electrics. The majority

of these vehicles were equipped with hoists, some of which were power driven. All of the hoists were of the types that have been adopted by the makers as standard and are generally exclusively controlled by the builders of the machines. Some of these are comparatively new, but aside from the latest power hoist of the Peerless trucks all have been described. The device is a rack and pinion construction, the racks being arched in form and coupled to the bottom of the body near the forward end. With the body lowered these are carried parallel to the forward ends of the chassis frame side members. The power is transmitted through the driving shaft and spur and bevel reduction gears to the spur gears that engage with the racks, and the control is by a lever at the driver's seat. The hoist is fitted with an automatic stop when it reaches an angle of 42 degrees and the full inclination can be reached in about 30 seconds under normal conditions. This was shown on a five-ton chassis, but it may be fitted to other sizes. The other power hoists were of the worm and nut, or shaft and chain type, save the Pierce-Arrow, which is a hydraulic construction. This was seen for the first time at New York.

The Locomobile display included a removable dumping body that is carried on rolls that fit heavy channels mounted on the chassis frame, and is moved backward and forward on the chassis by a worm shaft and nut. The intention is to use these with a loading platform from which the bodies may be taken when loaded and on which they may be placed when empty, that the chassis can be kept moving with the least delay necessary. This same construction was seen at New York, but at that time there was a platform body designed for lumber haulage with five tons capacity. The majority of the dumping bodies were of steel and while they differed in dimensions they were proportioned to the requirements of the chassis.

One of the most interesting exhibitions was that made by the Eldridge Manufacturing Company, which is agent for the Couple-Gear trucks and tractors and is builder of the Eldridge front-wheel drive vehicles. These are generally designed for heavy haulage. The novelty was the single-wheel driven dumping cart built for the Metropolitan Coal Company, which now uses six of the five-ton carts driven by the front wheels. The Couple-Gear wheels are used and the machines are adapted for the needs of the purchasers. The single-wheel cart is a big tricar in design with the load carried on large steel tired wheels. The front wheel is mounted in a cast steel yoke that is not unlike a bicycle fork and the head of this fork is fitted to a heavy steel member installed in the angle steel frame. The fork has a plain bearing in this member and is maintained by a large nut. The fork is turned by a hand wheel. The Couple-Gear wheel is built with a fixed axle with a large contracting band brake at either side. The cable connection is flexible. The steel channel chassis frame extends from the "head" of the front wheel back of the rear axle, which is of steel, and from this the battery box cradle is suspended, there being helical springs at the corners to protect it against shock. The body is mounted on a shaft that is also carried on helical springs, which eliminate rattle when the vehicle is driven unloaded. The body is coned from the rear to the centre of the bottom, and when dropped this line of the cone is at an angle of 90 degrees. The driver's seat is installed on full elliptic springs. The capacity of the wagon is two tons and it is intended for doing the work that a single animal would do. Because of the very short wheelbase it may be worked in space where any other machine would be useless. A machine of this type was built for the Third Avenue Railway Company of New York by the chief engineer of the company, and it has given admirable service, having ample power for a load of two tons on streets with grades up to 8 per cent., and having a radius of movement of approximately 25 miles to the battery charge.



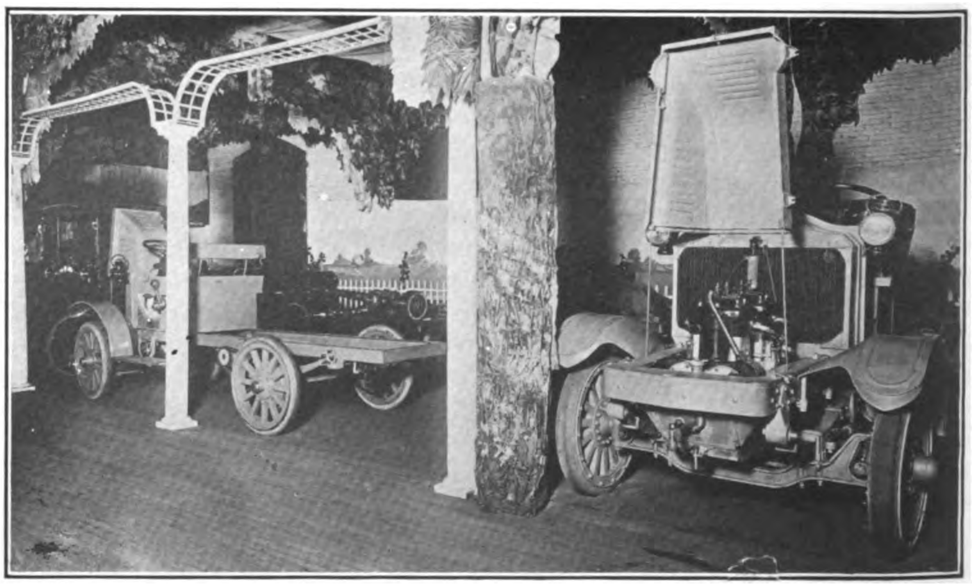
The Combination Display of Gasoline and Electric Machines Made by the General Motors Truck Company, the Only One of This Character in the Building.

Another interesting construction at this exhibit was a bottom-dumping Watson wagon of five tons capacity fitted with front wheel drive, built for the Rowe Construction Company of Boston. The battery is carried on the chassis, giving large road clearance, and back of the body is a large tool compartment. The Eldridge company also displayed a Couple-Gear tractor with trailer, built for the Curtis & Pope Lumber Company of Boston. This was conventional construction, but the high trailer has a standard forward on which is mounted a ratchet operated roller, and on this and a floating roller at the rear the load is carried. The rollers afford a means of quickly dropping load when ratchet is released. The tractor battery is underslung.

General Vehicle Chassis on Which Is Installed an Animal Wagon Body Used by George B. Hart for 16 Years, Adapted for a Retail Butcher Service.

The Sowers 3000-pound delivery wagon, built by the Sowers Motor Truck Company, Boston, seen for the first time at any show, is designed by Charles Basle, formerly a driver of racing cars. It is well thought out and follows conventional practise in every way. With the motor under a hood type the wheelbase is 140 inches, and with the motor under the footboards it is 120 inches, the loading space being the same with both. The motor is a Wisconsin with cylinders of 3.75-inch bore and five-inch stroke cast en bloc, with the valves enclosed, built for heavy service and conservatively rated at 25 horsepower by the maker. The cooling is by thermo-syphon circulation, a square tube radiator and fan. The lubrication is by a gear pump through a system of tubes to all bearings and by splash, the flow of oil being through a sight gauge. The ignition is by Bosch high-tension magneto. The carburetor is an automatic float feed type. The clutch is a leather faced cone with auxiliary springs, the transmission gearset a selective sliding gear construction with nickel steel shafts and gears, having three forward speeds and reverse. The drive shaft has two universal joints. The jackshaft is heavy, with large shafts and differential contained in a pressed steel housing. The drive to rear wheels is by side chains. The frame is a reinforced nickel steel channel, 4.5 inches width and four inches deep. This is carried on semi-elliptic springs forward and a platform construction at the rear. The rear axle is nickel steel and the forward axle an I section, both fitted with New Departure bearings. The brakes are external contracting on and internal expanding in drums on the rear wheels. The right side steering gear is a worm and nut type. The control levers are conventional. The wheels are 36 inches diameter, with 3.5-inch solid shoes forward and four-inch shoes rear. The purpose of the company is to make but this size of machine.

The Edison electric machines, made by the Edison Electric Vehicle Company of America, Lawrence, Mass., were shown in 1500 and 3000-pound sizes, and these had been hurriedly completed for the exhibition, so that they illustrated design rather than the perfection of detail. In both of those shown the drive was by worm and gear, but this or the conventional side chains is optional with the purchaser. The worm and gear are the David Brown design and make and are imported, but the full floating rear axles are built by the Standard Roller Bearing Company. There is a universal joint in the driving shaft and the motor is suspended from two brackets mounted on heavy frame members. The drive in the smaller machine is through the rear springs, the forward ends of which are fixed in the spring hangers, and a radius rod of skeleton type preserves the relation of the motor and the rear axle. The radius rod is pivoted so as to swing at the forward end. In the 3000-pound size the drive is through radius rods, with the springs shackled in the customary manner, but there is a radius arm that extends from the rear axle forward to a coupling mounted on a solid frame member. In the 1500-pound wagon the forward suspension of the frame is a platform spring, the forward ends of the side members being fixed in the spring horns, and the rear ends are shackled to a cross spring carried on a frame cross member. The effect is decidedly unusual. It is claimed for this that the machine is extremely easy riding and that considerably less current is required to drive it. The power is furnished by General Electric motors for all machines, and by Edison batteries, the battery cradles being underslung, but that of the small wagon is loaded from the top through a trap in the floor, while the larger size wagons load the batteries from the sides.



A Part of the Stand Where the Kelly Trucks Were Displayed, These Being the New Type with Water-Cooled Engines and Flexible Frames.

While this is the first display made by the company the machines have been used for four years and are said to have given excellent satisfaction.

The Jeffery delivery wagons, which are of 1500 and 2000 pounds capacity, were shown for the first time in the East and were especially interesting. The 1500-pound chassis is practically the Thomas B. Jeffery Company's pleasure vehicle design, strengthened for heavy service, with the same motor used in the pleasure vehicles, but the 2000-pound vehicle is a new design throughout, and while conventional is thoroughly practical. The lighter machine is driven by shaft, but the larger power transmission is by double side chain. The wheelbase of both is 120 inches. With the small chassis the load is carried with 40 per cent. on the forward axle, but with the larger 75 per cent. of the load is on the rear axle. Both have right side drive and the control is by the usual levers.

The Marmon light delivery wagon, built by the Nordyke & Marmon Manufacturing Company, which was shown for the first time at any exhibition, attracted much attention. The motor is the Marmon design with four-inch bore and five-inch stroke, of the T head type, and it is fitted with a governor that controls a throttle valve in the intake manifold. The maximum speed is 20 miles an hour. This governor may be sealed. The motor has all the Marmon features, with the heavy crankcase and the Marmon system of lubrication. It is mounted at three points and with a slight inclination to insure a straight line transmission of power. The ignition is by high-tension magneto and battery, using one set of spark plugs. The clutch is a cone, faced with anti-friction material. The drive is by shaft with the transmission gearset incorporated with the rear axle. The rear axle is a full floating type with a single ball bearing of large size mounted in the centre of each wheel hub. The front axle is an I section. The frame is pressed steel channel section and is carried on full elliptic springs at the rear and semi-elliptic springs forward. The wheelbase is 120 inches and the wheels are 32 inches diameter, fitted with 32 by four-inch tires, single pneumatic forward and dual pneumatic rear, but solid tire equipment is optional. The drive is right side with the usual lever control, with service and emergency brakes of the internal expanding type operating within 16-inch drums on the rear wheels. The design throughout is admirably developed.

The other vehicles shown were displayed at the New York or the Chicago shows and, while in every way interesting, do not call for special attention in this review. The Stanley steam machines, always shown at Boston, were the only vehicles of this type seen at any of the shows throughout the country. The chassis were fitted with bodies of admirable design and finish and were notable from the fact that they were the equal of any seen in the exhibition.

The showing of fire apparatus was not extensive, there being a White combination hose and chemical wagon, a Knox hose and chemical wagon and a Knox pumping engine, a Kelly hose and chemical wagon, a Federal hose and chemical wagon and a Pope-Hartford hose and chemical wagon. All of these were especially interesting, the White machine having a body design in which the entire space below the top of the sides is given over to hose storage and carrying space, while above this, in the centre, is a longitudinal seat for the men, in which can be stored their clothing, etc.

Of the special body constructions shown, one that attracted much attention was mounted on a Peerless chassis and is to be sent to Porto Rico, where it is to be used in passenger transportation. The chassis is three tons capacity and on this is a platform with a standing canopy having seven stanchions at either side. There are five transverse seats, each of which will seat six persons, and there are two longitudinal seats at the rear with a space for baggage between them. The capacity is 40 persons, and at either side are two long running boards so that passengers can enter or alight from any seat. These steps may be raised and folded when the machine is under headway. The purpose of the owner is to place the machine in service that will give it a run of 120 miles each day, making a round trip in two days.

An Alco 6.5-ton chassis with tank for the haulage of tarvia products and the application of tarvia to road surfaces, built for the service of the Barrett Manufacturing Company, was prominent among the exhibits. The company has had trucks in service for two years. The first were fitted with tanks into which the tarvia was loaded at the works at Everett and thence hauled to the work, where they were hauled behind steam rollers, hose connections from the boilers giving heat to liquify the tarvia and a sufficient pressure to force the tarvia through spray headers on to the roadways under construction. The next were fitted with power pumps, driven from the transmission, that forced the tarvia from the tank at a pressure of 100 pounds, and gave a control to the application by the variance of the pressure. The machine exhibited has an apparatus that is much improved and in which the pump may be used to fill or empty the tank, and there is a coil of pipe through which steam may be forced to heat the contents in the event of cooling from a long haul.

There was a very large showing of service vehicle tires, practically every concern of prominence being represented, and in these there was a decided interest. The number of accessory exhibitors was 60, and these were generally those of supplies and equipment, there being but very few part makers represented.

John A. Graham, formerly sales manager for the Westfield Motor Truck Company, has been appointed district manager for New England for the Sanford Motor Truck Company, Syracuse, N. Y., and will make his headquarters at Boston. Mr. Graham was formerly a resident of Boston and is widely and favorably known to the trade.

NEW CHASSIS CONSTRUCTION DETAILS.

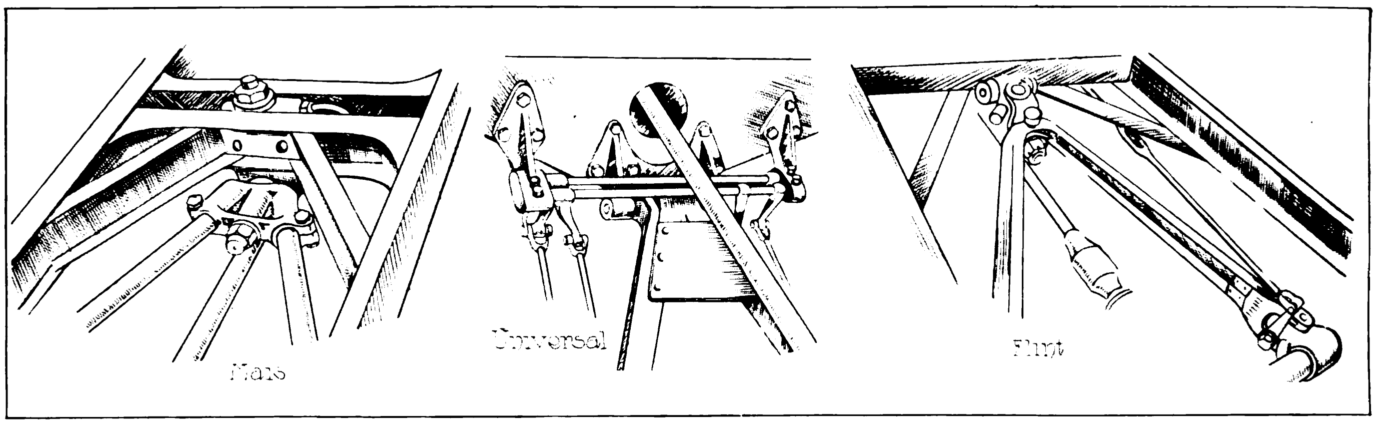
Increased Length and Lowered Forward Ends of Radius Rods Lessen the Upward Thrust of Tractive Effort and Minimize Tire Wear---Some Improved Radiators.

THE majority of manufacturers of service vehicles are disposed to adopt what has been found to yield satisfactory service as a standard, and to develop the construction in such details as experience justifies. This does not mean that progression is lost sight of, but it does emphasize that it is far better judgment to first have a design that will have power, endurance and economy, and then work out improvement of detail that will simplify and strengthen wherever possible or practical. It is natural enough that each designer should study his own work, and observation of many vehicles will demonstrate possibilities that might not be realized with one or several. Not only this, it often requires a considerable period of service to establish conclusively that a change could be advantageously made, and an improvement is seldom determined until after a careful consideration of the needs and the results are accurately estimated.

There will undoubtedly be wear with use, and wherever there is movement the intention is to provision to minimize loss through wear may be another way of putting it.

The tendency has been to increase the proportions of components that are subjected to great strain or sudden stresses, and which may be weakened by the continuance of vibratory shocks. There has been realization that such parts may be seemingly perfect and yet the material not be up to the standard. The design may not endure because of unforeseen conditions, and there may be other reasons why a change should be made. These necessities have brought about what are referred to as refinements and improved details, but it may be accepted that the purpose of the designer is to remedy conditions that should not continue to exist.

This statement should not be understood to be criticism, but it is to emphasize that every designer is making his machine better when necessity or desirability impels a change. Improvement should not be regarded as confession of fault or weakness, and there



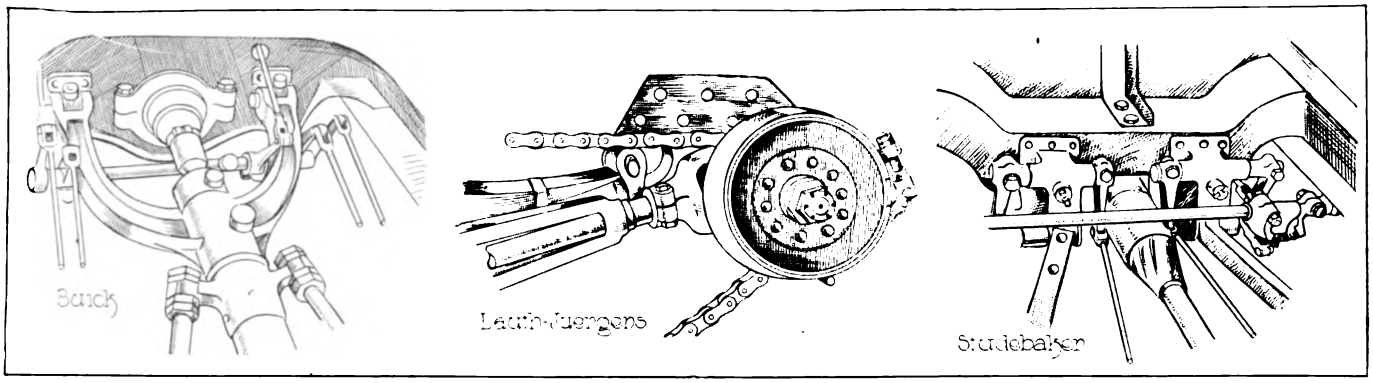
The Perfected Thrust Block of the Mais Design, the Forward Radius Rod Ends of the Worm Driven Universal Wagon, and the "Triple-Acting" Radius Rod of the Flint Machine.

vide means of lubrication and to have the bearing surfaces sufficiently large so that the destructive action will be slow, while adjustment that will compensate for lost motion is absolutely essential. These conditions can be provided for without material observation, but there are others that cannot well be determined. These must be noted and sometimes effects can only be learned save under unusual and peculiar circumstances.

Frequently a construction may be regarded as in every way adequate to the requirements, and it may be in every way correct from an engineering viewpoint, but the assembly may be such that time may be lost in giving attention, in making adjustment, in making replacement, or other necessary work. This has led to what is summarized under the term of simplification, or perhaps accessibility, while lessening of expense with reference to cost of parts, or additional is no reason for condemnation of what has previously been produced. Yet it cannot be accepted that a change has eliminated every chance of further perfecting.

In examination of the different machines, unless one is familiar with the constructions, there may be apparently little if any difference as compared with the models previously produced, but with knowledge of the improvements the attention to development is apparent.

One of the details that is given very general attention is the construction of radius rods, and there is seemingly an increased tendency to lessen the angle of inclination that there may be a more direct forward driving thrust. This is to be noted with many of the shaft driven machines, and to some extent with those in which the drive is by side chains. The vehicles in which the shaft is used are generally those where the



The Enlarged Torque Tube Yoke of the Buick Delivery Wagon, the Jackshaft Bracket of the Lauth-Juergens Truck, and the Radius Rod Coupling of the New Studebaker 3.5-Ton Truck.

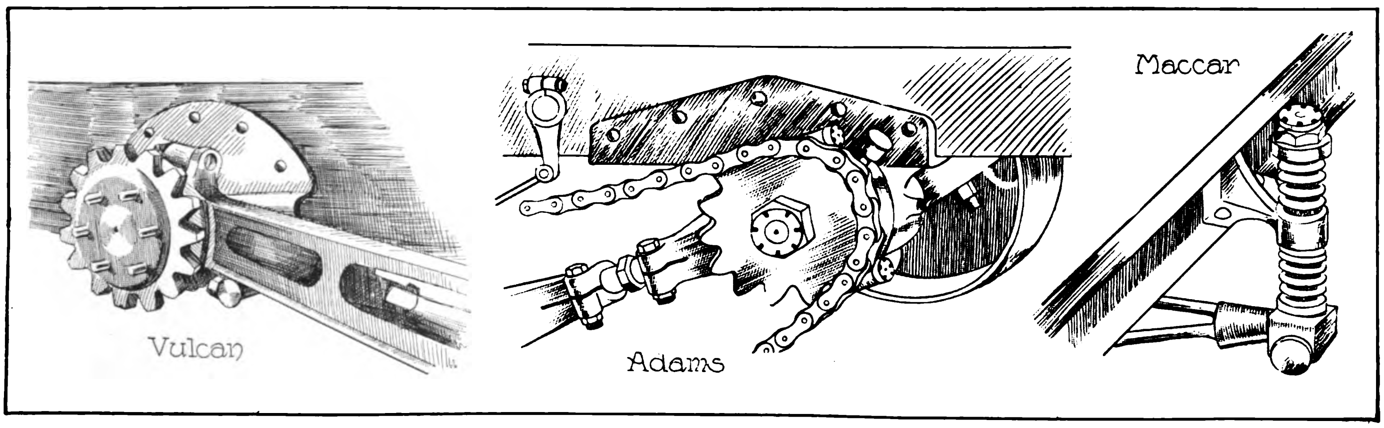
system is the concentric gearing, such as the Mais, the Brown, the Piggins, the Lord Baltimore, the Studebaker, the Atterbury, and with the worm driven Universal, although there are constructions in which the chains are used where the forward ends of the rods are dropped by using longer jackshaft hangers so that when a load is to capacity the normal driving effort is exerted in what may be regarded as a straight line.

Though the speed of the service vehicle may be comparatively slow and the springs of the machines so designed that there will be gradual deflection or reflection, there will be the vertical movement of the rear axle proportionate to the inequalities of the road surface. The tractive effort is assumedly the same and the angularity of the thrust is dependent upon the degree of movement. The longer the rod the less the degree of angularity and the upward thrust. The change of driving effort has a decided effect upon tires, for there is a greatly varied stress upon them, and this is in every way different from that of load carrying. This constant variance, however, is not generally considered with reference to tires, but to the chassis. Lengthening the radius rods and coupling them to frame members causes the thrust to be directed more longitudinally, and there is not the "lift" in the centre of the chassis frame that would cause extreme strain, especially when the load is, in great part, back of the radius rod connection.

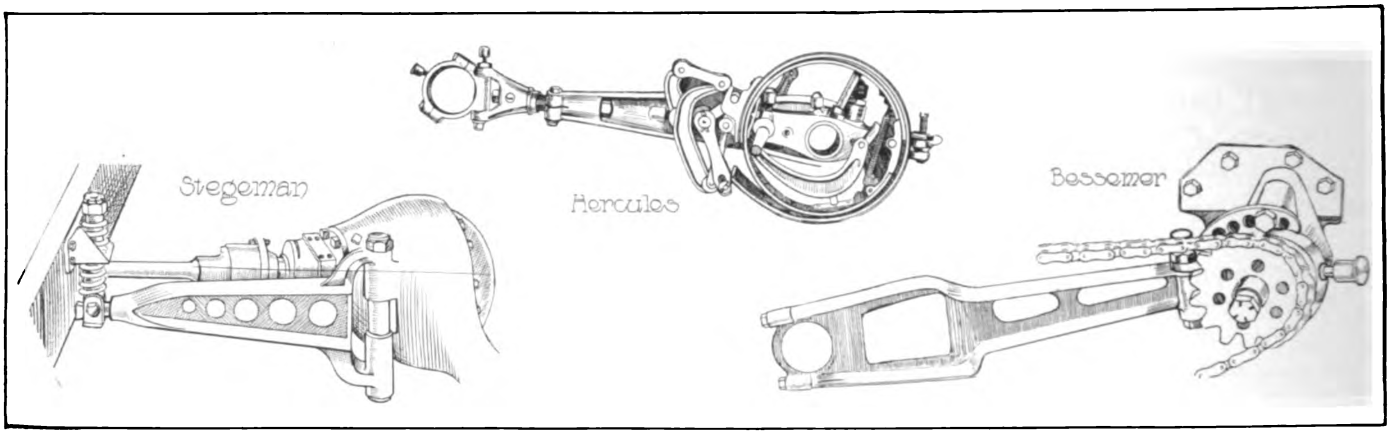
In the Mais construction the chassis frame is designed with two cross members well forward, between which is set a special block or fitting. The rear cross member is reinforced against the forward thrust by heavy channel diagonals from the centre to either side member. The thrust block carries a large socket, into which is fitted the globe of a short shaft, and on this shaft is mounted a yoke. In the ends of the yoke are sockets, into which are set the forward ends of the radius rods, clamping bolts affording means of adjustment when the relation of the rear axle has been determined. This yoke is pivoted on the shaft so that the movement of either end of the rear axle is not resisted, and the globe and socket connection permits the vertical action of the axle without stress. The globe and socket joint is lubricated by two large grease cups connected with the block by heavy copper tube.

The Studebaker construction differs from this in that there is a heavy centre frame cross member, mounted in the channels of the side members and dropped to lower the long radius rod ends. The driving shaft is under this member and at either side of the shaft secured to the member are two large brackets. The radius rods are mounted in the lower part of these brackets and in the top of each is a small shaft with a long bearing to the ends of which are clamped two lever arms. The arms project downward. To the outside arms are attached the forward pull rods, and to the inside arms are secured the rear pull rods of the linkage of the two transmission brakes, this construction giving a direct draw of the rods in line with the shaft. The radius rods have a free motion with the vertical movement of the rear axle.

In the Universal worm driven ton wagon the centre



The Bolt-Retained Jackshaft Sprocket of the Vulcan Trucks, the Long Jackshaft Hanger of the Adams Machines, and the Forward End of the Radius Rod of the Maccarr Delivery Wagon.



The Torque Lever of the Stegeman Wagons and Trucks, the Radius Rod of the Hercules Machines and the Vernier Adjustment of the New Bessemer Chassis.

cross member is a wide web in which is a round hole through which the shaft extends. Below the hole and under the shaft is a large bracket with two ears or lugs wide apart. The radius rods are of angle steel connected at the forward ends by a wide gusset plate, and ahead of this is mounted between the ends of the rods a fitting. A shaft extends through the lugs of the bracket and the fitting, on which the rods may move freely with the movement of the rear axle. At either side of the central bracket are two others, and in these are mounted the shafts for the service and emergency brakes.

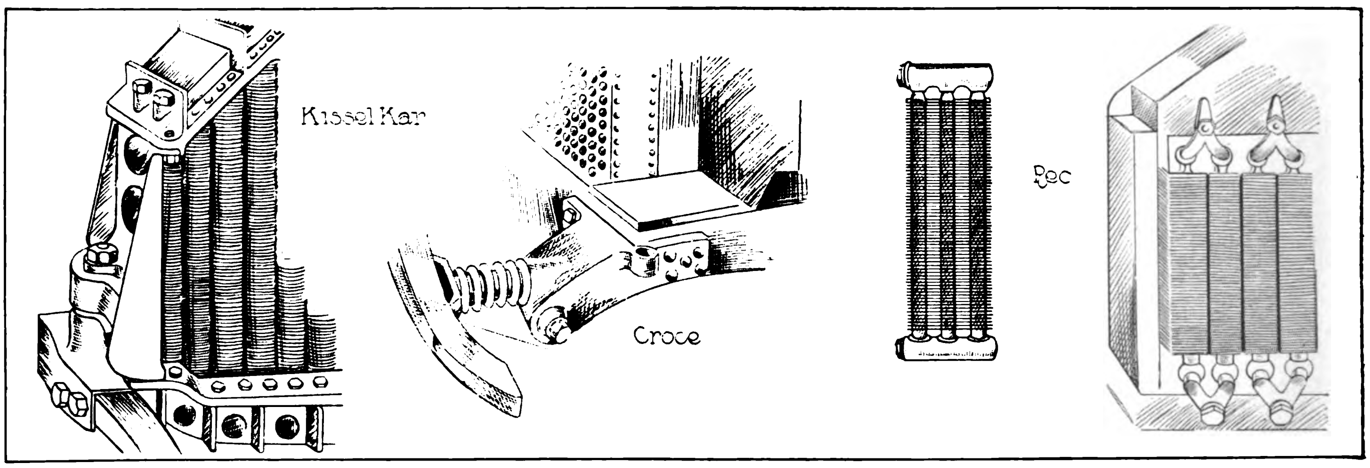
The radius rods of the Flint wagon are steel channels with yokes at the rear ends, the forward ends being joined by a heavy curved member, through the centre of which is a yoked fitting, in which is a shackle that is mounted in a yoked bracket carried on the centre frame member. The coupling allows a transverse and vertical motion, and the rods may also twist on the supporting member, eliminating every probable stress. The yoked rear ends are connected with the rear axle so that a transverse movement is possible.

The Buick delivery wagons are built with the driving shaft enclosed in a torque tube that has a large, wide yoke with the ends carried in brackets on a large frame cross member, pivoted to allow a free vertical movement of the rear axle, and directly behind the yoke is a fitting in which the forward ends of the radius rods are secured after adjustment as to correct relation. The construction is not new, but it is extremely heavy and intended for endurance in service. Beneath the ends of the torque tube yoke are brackets that carry the brake shafts, with the forward pull rods extending through holes in the frame cross member.

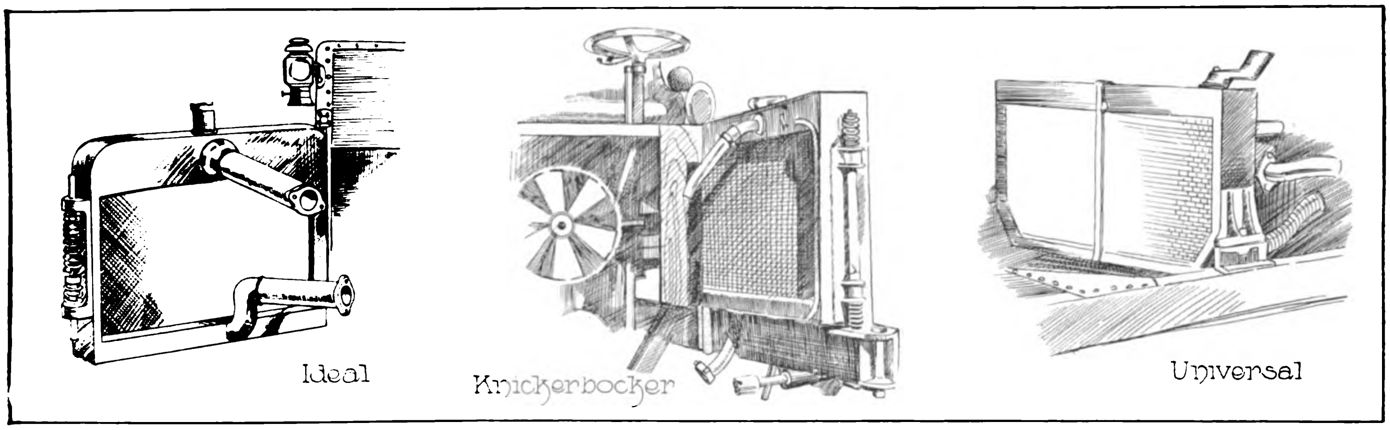
The 1500-pound Maccarr wagon chassis has a torque rod that has round upper and lower members to secure lightness. The forward end is shackled to a member mounted in a bracket on a frame cross member that is carried between helical springs. The rod moves at the rear end with the rear axle and is free to turn on the shackle at the forward end, and the possibility of vibration is taken by the helical springs and the thrust is very nearly direct at all times.

In the Stegeman machines of one ton or more capacity the starting and braking stresses are taken care of normally by the pressed steel chain cases that serve as radius members, but in addition to this there is a torque lever, so-called, that is swivelled at the left side of the differential housing of the jackshaft and is coupled to an upright member supported by a bracket on the centre frame cross member, this vertical member having a slight movement in a guide between helical springs. This is expected to resist extreme strains and protect the differential gear and driving shaft.

The Bessemer wagons have an adjustment for the forward ends of the radius rods in the jackshaft hanger in the form of an eccentric and a vernier arrangement



The Aluminum Radiator Frame of the New 2500-Pound KisselKar Delivery Wagon, the Expanded Tube Cooler of the Croce Vehicles and the Sectional Radiator of the 3000-Pound Reo Machine.



The Swinging Radiator of the Ideal Machines, the Hinged Construction of the Knickerbocker Trucks, and the Protected Cooler of the Universal Vehicles Under the Driver's Seat.

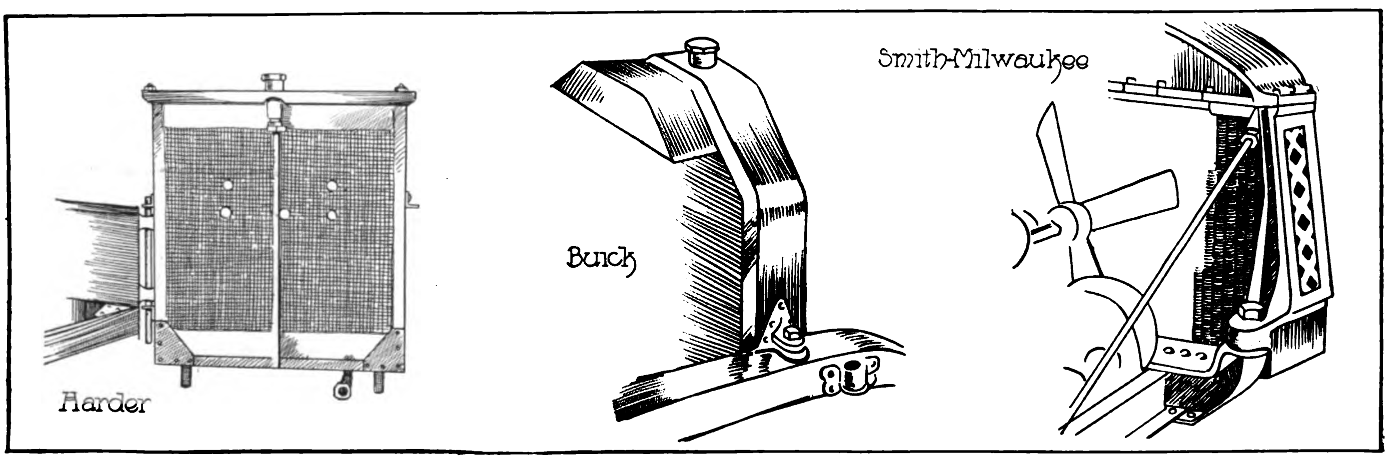
of a segment of the eccentric, which may be secured in any desired graduation by a bolt. This is independent of the adjustment that may be made at the axle end of the rod.

The radius rod of the Hercules delivery wagon is constructed so that while the rear end oscillates on the rear axle it carries the brakes, both external contracting and internal expanding, and the forward end is pivoted at the jackshaft hanger clamp. The adjustment is made by a bolt that is secured by clamping. Provision is made with the Adams and Lauth-Juergens machines to stiffen the chassis frames where the jackshaft hangers are installed by unusually long plates, in both cases the fittings extending backward from the hangers, affording very secure anchorage. One of the features of the Vulcan trucks is the bolted-on sprockets, which can be removed from the end flange of the shafts by loosening six bolts. This method is regarded as more economical than keying.

The necessity of protecting radiators, and making possible quick repair has been worked out well in the large Reo delivery wagon, in which there are 24 sections, these being held at top and bottom by yoke clamps that each retain two ends. These sections have three tubes each. It is possible to remove a section and by plugging the four holes by which it is connected for the circulation of the water with the base and header, to continue to use the machine. In fact, a number of the sections may be removed and the efficiency of the radiation will be such the machine can be operated. Several of these sections can be kept in reserve and the vehicle need never be out of service from a radiator leak or damage.

The Croce radiator is typical boiler construction, the horizontal tubes being of large size and expanded in the front and back of the cooler. In the event of a leak or damage the tubes may be plugged temporarily, or expanded to make a tight joint. The radiator of the KisselKar 2500-pound delivery wagon is a finned tube type, the tubes being mounted in an aluminum frame that is seemingly massive and is bored to reduce weight, while it is heavily ribbed to secure radiation. This radiator is mounted in enclosed spiral springs carried on the frame side members.

The radiators of the Universal machines of the motor under the floor type are located at the back of the seat and beneath it, being protected by the seat frame and a grating against damage from movement of the load or while handling the freight, and these have a flat top with a header carrying a large filling spout. The radiator is mounted on supports located on the frame side members. The Buick radiator, of the flat tube type, has an enlarged or auxiliary header that overhangs the motor and this gives a considerably increased water capacity with the same radiation area. The Smith-Milwaukee truck radiators are with the header and base of considerable capacity and the finned radiating tubes are set into these with rubber



The Provision Made with Harder Trucks for Accessibility, the Auxiliary Header or Tank of the Buick Delivery Wagon, and the Sectional Skeleton Radiator Frame of the Smith-Milwaukee Vehicles.

gaskets. In the event of leak or damage any number of these may be removed and other tubes installed with comparatively little labor. The headers and bases are assembled with skeleton side members to assist radiation. The radiators of the Harder, Ideal and Knickerbocker machines are constructed to swing, so that by loosening the water manifold connections and removing the bolts retaining the supporting brackets at the right side with the Harder and the Knickerbocker vehicles, and the left side with the Ideal, the radiators may be swung as doors and access may be had to the motors or to the coolers for necessary work.

MARTIN TRACTOR IN HEAVY WORK.

Hauls 19 Tons of Stone at Eight Miles an Hour in San Francisco Traffic.

The possibilities of handling heavy freight by the use of motor vehicles are being demonstrated daily at San Francisco, Cal. M. Lennegan & Son's Knox-Martin tractor recently hauled 19 tons from pier 25, Lombard street, to Howard and Seventh streets in a very few minutes. To have transported the same amount of stone over the distance by horses would have easily consumed half a day.

On the low-bed truck attached to the tractor was one piece of granite weighing 11.5 tons. Behind the tractor was attached another stone wagon as a trailer, and on this was a piece of stone weighing over eight tons. The machine was able to draw the load easily at eight miles an hour in the open traffic.

MOTOR FUEL INVESTIGATION.

Research for Substitutes for Gasoline to Be Made Under S. A. E. Supervision.

A committee appointed by the National Association of Automobile Manufacturers to investigate the possibilities of satisfactory substitutes for gasoline for fuel has arranged with the Society of Automobile Engineers for the technical tests and general research to be conducted by that body, while the association will possibly determine such matters as are of a purely commercial character. The association committee considered in a general way the aspect of the petroleum industry, the source of supply available, probable oil fields unexploited, transportation and storage facilities, refining cost and other elements of material importance.

It was considered best to have the scientific research made by the society and to have this include fuels that are available and differing carbureting instruments, and it is probable that inventors and others interested will be given opportunity to demonstrate hydrocarbons and the possibilities with reference to manufacture. Of course cost will be a material factor. The research work to be done will cover so far as may be necessary the work of the association's committee, and besides the investigation of the fuels practically the same attention will be given to tests of carburetors. In addition the investigators will endeavor to learn what changes in present carburetion methods will increase the efficiency of and satisfaction with low grade gasoline.

It is stated that the different oil producers and allied interests are willing to co-operate with the society in the work. It is pointed out that the fuel supply of the future is an intensely important subject, so that it will be necessary to determine so far as possible the hydrocarbon that will be most economical and the most practical method of utilizing it. The policy of the society in the investigation will be, with reference to carburetors, to determine what physical and chemical proportions are most desirable in a fuel and the best means of applying them, as well as to establish definite relations between the necessary velocities, volumes and temperatures.

FOREIGN MARKET DEVELOPMENT.

Secretary of Commerce Redfield Proposes Means for Trade Exploitation.

Secretary of Commerce Redfield makes the definite recommendation that it is necessary in the study of the activities of the manufacturing nations of the world to add to the consular service and other channels of investigation now available, by the creation of a division of the bureau of foreign and domestic commerce that will have funds and attaches desirable to give the fullest information on all subjects beneficial to the business life of the nation.

He proposes that there should be a corps of commercial attaches accredited to the principal states of Europe by the Department of State, yet under the guidance of the Department of Commerce, whose members would have the same purpose in commercial and industrial life that the military and naval attaches stationed abroad now have. He suggests that such a corps could make general investigation to amplify the local reports of the consuls, and direct attention toward every activity that justified. He believes that the return would be in every way beneficial and while he is of the opinion that the appropriation necessary to insure such service need not be large, it would have to be sufficient to secure the class of men who could obtain and prepare the information.

An Alco truck, owned by John Lucas & Co., Philadelphia, Penn., loaded with three tons of paint, was driven from Philadelphia to Pittsburg, a distance of about 400 miles, in five days, the start being made March 17. The night stops were made at Lancaster, Gettysburg, Bedford and Greensburg. This was the first overland delivery made between the two points in 25 years, when horses made the journey in several weeks. The machine is now in use at the Pittsburg branch of the owner.

INDUSTRY RAPIDLY RECOVERS FROM DISASTER.

AS A result of the recent flooded conditions in Ohio and Indiana, hundreds of lives were lost, thousands were made homeless and property totalling millions of dollars was destroyed. For a time it was feared that the automobile industry and lines closely allied therewith had been seriously affected. Reports from the stricken district immediately after the work of re-establishing communication was begun would seem to indicate that such concerns were particularly fortunate.

Several companies engaged in the production of motor trucks are located in the area visited by the floods. The cities most seriously affected were Dayton and Troy, O., and that portion of Indianapolis, Ind., known as West Indianapolis. A number of other cities and towns in this district were inundated, and the whole section suffered more or less through the destruction of bridges, highways and railroad lines. It seems probable, however, in the light of recent reports, that the highways themselves are not in as bad condition as was at first supposed, although of course, traffic cannot be resumed under anything like normal conditions until provision has been made for replacing the bridges washed away.

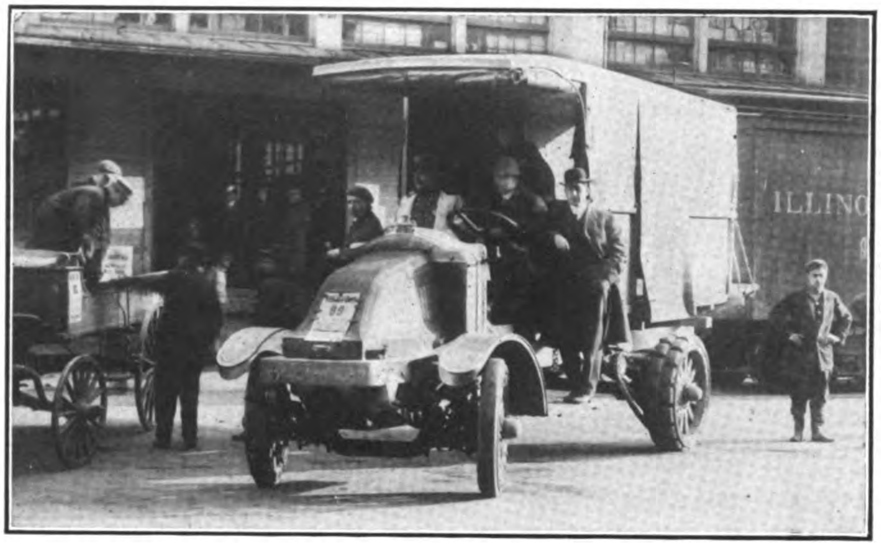
In Dayton, the concerns to suffer directly from the flood were the Dayton Motor Car Company, Dayton Engineering Laboratories Company and the Apple Electric Company. The first is a subsidiary of the Maxwell Motor Company and formerly was engaged in the production of Stoddard-Dayton cars. The two others make starting and lighting systems. The first floors of these buildings were filled with water, but it is stated that practically no damage resulted to stock, much of the space being devoted to offices. The Speedwell Motor Car Company, maker of Speedwell cars and trucks, is located on high ground and the water came no nearer than two squares.

Troy also was in the heart of the flooded district in Ohio. The Troy Wagon Works Company, which produces wagons used as trailers for motor truck installations, reports that the damage to its factory proper was very considerable, but prompt and energetic measures soon restored conditions to normal. The office was badly flooded, damaging records and hampering work temporarily. The Troy Carriage Sun Shade Company, maker of windshields, also suffered from water and did not expect to be able to resume operations before April 7.

The Indianapolis factories partially submerged were those of the Marmon, Marion and Pathfinder, and the body works of R. J. Irvin & Co. The second story of the Marion plant was utilized as a haven of refuge for many people who were caught in their homes when the levee on White river gave away. All these concerns report that the finished stock was out of harm's way and that they do not expect to be delayed materially in filling orders. The Waverley Company, maker of Waverley electric trucks, is located on high ground and reports that it will be able to make shipments as soon as the railroads are ready to take them.

The Ideal Auto Company, Fort Wayne, Ind., maker of Ideal commercial cars, says that its factory was under four feet of water for 10 days, but the direct loss in materials is not nearly so great as was anticipated. The company fears its main loss will come through the fact that it had been doing a good business and had many prospects in towns which suffered much more than Fort Wayne.

At Anderson, Ind., the electric light and water plants were forced to close down, and Lambert farm tractors, made by the Buckeye Manufacturing Company, were impressed into service to supply the necessary power to pump water from several of the quasi-public service institutions. The truck plants of the Buckeye company and the Nyberg Automobile Works were not damaged.



One of the Six Kelly Trucks Taking on a Load of Supplies for the Flood Refugees in Dayton, O.

The Kelly-Springfield Motor Truck Company, Springfield, O., reported that its plant was in no way disturbed by water, but the fear was expressed that the receipt of material and the shipment of completed vehicles might be delayed somewhat.

Water came very close to the plant of the Willys-Overland Company, Toledo, O., maker of Overland delivery cars, but did not enter the building. So far as can be learned the industry in Toledo did not suffer materially.

At one time it was feared that the tire concerns in Akron, O., were heavy losers, but it transpires that but one building was reached by the water, this being

the engine room of the Goodyear Tire & Rubber Company, maker of Goodyear tires. The fires were put out, but the damage was very slight.

At Youngstown, O., the Republic Rubber Company, maker of Republic tires, placed its private water supply at the service of the city when the municipal pumping station was flooded. By so doing, it undoubtedly aided in reducing loss by fire. The second morning of the flood fire did some $75,000 damage in the business district, and without the tire company's water supply it probably would have communicated to other buildings.

The Rutenber Motor Company, Marion, Ind., reports its Marion plant safe, but the foundry at Logansport, Ind., is said to have been flooded to an average depth of two feet. The shipment of Rutenber motors will not be delayed, however.

While the water did not reach the plant of the Ross Gear and Tool Company, Lafayette, Ind., it was shut down for a week. Edward A. Ross, secretary of the company, believes that the result to the industry will not be serious and he expects that more trucks will be bought than would have been because of the large amount of work that must be done over the flooded district.

Ideal Truck Utilized to Pump Out Flooded Cellars in Its Home Town of Fort Wayne, Ind.

So far as has been learned this practically comprises the list of companies affiliated with the motor truck industry which were seriously affected. Several other motor car and accessory manufacturers have reported no damage. The chief concern is with the railroad situation. With all schedules temporarily abandoned, the problem of receiving material and shipping completed products is very unsatisfactory. However, the railroads already have begun work of restoration, and there seems little doubt that previous schedules will be resumed as nearly as possible within a short time.

Many of the local dealers and distributors have lost much more heavily than the manufacturers. In Dayton the retail salesrooms were located on Third street, in the business centre, which suffered most of all. Not only were the buildings demolished, but show cars, office records, etc., were entirely destroyed. The situation in this respect in other cities was not so bad, however.

In the work of rescue and in the matter of distributing supplies and aid to the rescued, motor trucks and automobiles played a decidedly prominent part. Many manufacturers sent several vehicles to Dayton, among which may be mentioned the six Kelly trucks from the Kelly-Springfield Motor Truck Company, Springfield, O., and the eight Packards from the Packard Motor Car Company, Detroit. In Indianapolis several White trucks, made by the White company, Cleveland, O., did splendid work. Had it not been for these vehicles, in many instances it would have been impossible to transport food and supplies, since the railroads were unable to reach the needy ones and horses were wholly incapable of coping with the flooded conditions.

The same situation prevailed, in a measure, in connection with the tornado at Omaha, which preceded the floods of Ohio and Indiana by only a few days. Over 200 people were killed, many hundreds injured, thousands left homeless and property valued at between $5,000,000 and $10,000,000 destroyed as a result of this storm. Motor vehicles responded promptly, carrying the injured to hospitals, transporting soldiers, firemen, police, surgeons and nurses to the afflicted district, and distributing food and supplies.

In each instance the thorough practicability and dependability of the automobile, whether designed for business or pleasure, was ably demonstrated. And particularly as a result of the floods, it may be forecasted that there will be a decided market for the mechanical transport in all lines of activity in the districts affected. The industry is fortunate in escaping with so little damage, although in this connection it should be remembered that thousands of men employed by the industry lost all their household effects, and in some instances there was deplorable loss of life as well.

Since the above was written, additional information has been received from the Brown Commercial Car Company, Peru, Ind., maker of Brown vehicles, in which it is stated that the water in this factory averaged about two feet. Vice President C. A. Wallerich writes that the goods damaged were of a character which could be replaced easily and that the concern will not be hampered. The chief delay was occasioned by the fact that most of the workmen lost all their personal effects.

The Crescent Motor Truck Company, Middletown, O., writes that the flood did not reach its factory.

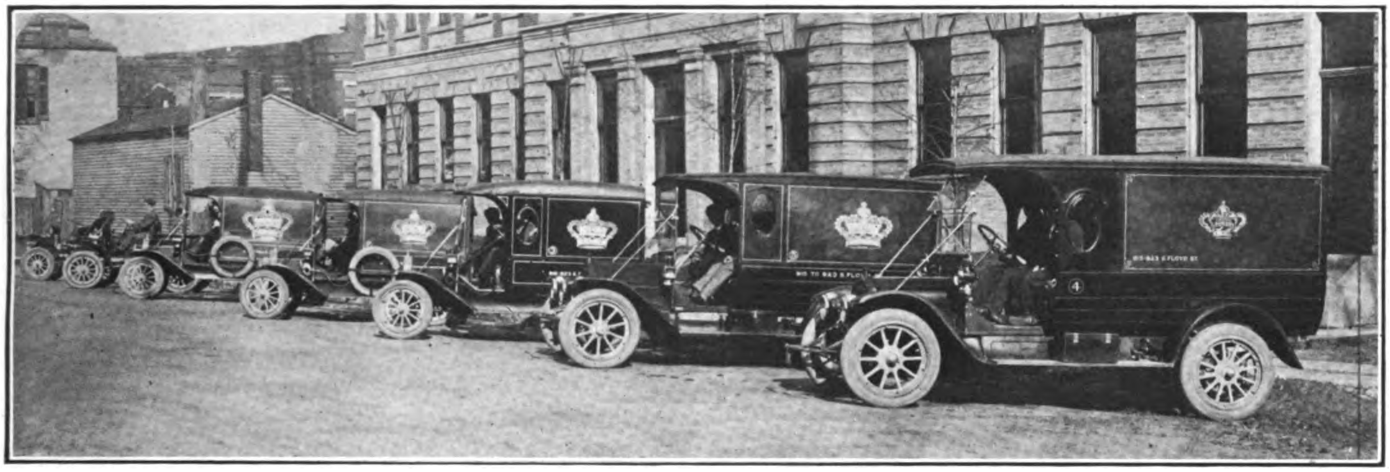
MOTOR WAGON ECONOMY IN LAUNDRY WORK.

Only Exclusive Motorized Service of America, at Louisville, Ky., Affords Business Development of Surprising Proportions and Yields Great Economy.

By G. D. Crain, Jr.

THE Crown Laundry Company has for a number of years been regarded as one of the most progressive business enterprises of Louisville, Ky., and while it is known to the people of that city as being one of the few concerns in it using motor vehicles, it is hardly probable that even the best informed authorities of the power wagon or laundry industries know that it is the only firm of the kind in the United States, and probably in the world, using a complete motorized equipment.

The business has been developed consistently and Manager W. A. Haas has created a reputation that is justified by the building occupied, the equipment and the character of the work as being high class. It was not need of prestige that prompted Mr. Haas to make experiment with motor vehicles in the collection and delivery of his work, and it was a realization of the possibilities of economy that impelled him to change from animals to power delivery wagons after he had given the machines a thorough trial.



The Delivery Equipment of the Crown Laundry Company, Louisville, Ky., the Only Concern of the Kind in America That Has Installed a Completely Motorized Service.

The experience of Mr. Haas is unusually interesting in that it in every way controverts the very generally accepted belief that motor wagons are not economical in work where the stops are frequent and the routes are sometimes short. He has now six machines in use and utilizes them to admirable advantage. His business does not differ from any other of the same character and he has not revolutionized methods, but he has found it possible to obtain results by careful study of the possibilities and adapting the service to the conditions.

Had Mr. Haas been willing to accept the assumption of those who believe the horse is the cheaper for work where the routes are within a city, and where the stops are generally frequent, he would not have felt willing to abandon the animals and made the investment necessary for the change. Having found what he could accomplish with one machine, after working it for a sufficient length of time to justify an opinion, he decided to motorize his transportation and did so.

In the work of horses the usual limitations of animals were experienced, these being principally a diminished capacity in the periods of the year when there are extremes of temperature, a necessity of having a reserve to provide for ordinary emergencies, the lack of elasticity of service in the event of need and the constantly increasing expense of maintenance. In addition, the demands for serving the customers in all parts of a city of extensive area and the constant increase of the business meant the purchase of more equipment. The question was whether or not it would be best to continue to utilize horses or learn what could be done with motor vehicles. Mr. Haas decided he would try out the automobile.

The first vehicle purchased was a single-cylinder Cadillac pleasure car. The chassis was stripped and it was converted to a light wagon by the installation of an open express body. The machine was utilized for what is known as a "pick up," and made the round of the agencies, collecting and returning baskets, covering a good deal of the city each day. This made possible bringing to the laundry each day washings that would not have been received until later, and with the earlier collection the work was considerably expedited. When this machine was installed eight wagons were used.

For the purpose of demonstrating the actual cost of the horse service it may be well to show the cost for a year of maintaining it, and 1910, before a machine was

placed at work, will sufficiently show the expense:

Investment.

Eight wagons at $200 each	$1600.00
Eight horses at $175 each	1400.00
Eight sets of harness at $30 each	240.00
Total	$3240.00

Operation.

Stable help at $50 a month	$600.00
Feed	1219.00
Wagon repairs	212.00
Harness repairs	71.80
Shoeing	312.90
Total	$2415.70
Wages, drivers, helpers, etc.	5760.00
Total	$8175.70
Interest on investment at 6 per cent	194.40
Total	$8370.10

The driver of each wagon had charge of the delivery and was paid $60 a month, and on some of the more congested routes "jumper" boys assisted them. Each driver handled his own route and in cases of special work and the like the delivery was sometimes taken care of by an emergency trip. Generally each driver had practically all he could do, the first part of the week, as with all laundries, being given over to collections and the latter part to deliveries.

DAILY RECORD DELIVERY TRUCK No.______

Distance covered.......................... ______ Miles

Amount gasoline used.......................... ______ Gallons

Amount oil used.......................... ______ Pints

Puncture or blow-out, casing No.......... ______

Speedometer reading.......................... ______ Miles

Casing put on.......................... ______

Remarks: ______

Date ______ ______ Driver

Daily Report of Drivers, Printed in Black on White Paper, Three Inches Length and 5.5 Inches Width, Padded.

The work with the Cadillac "one-lunger" was so satisfactory that three Ford light delivery wagons were bought, and then came a White 1500-pound delivery wagon and a Cadillac delivery wagon of approxlimately the same capacity. As the machines were bought the horses and wagons were disposed of and then the stable was converted into a garage. This building is of brick and contained 10 box stalls. The floor was cleared and a cement flooring that may be flushed was laid, this having good drainage that it may be kept clean, and a gasoline storage outfit was installed with the pump in a separate structure about 50 feet from the garage building. The garage was piped for a supply of compressed air, served from a compressor in the laundry. The garage, 25 by 50 feet, is located at the rear of the laundry plant, and convenient to it, reached by an alley, is a loading platform. This arrangement, which was planned when the laundry buildings were erected, eliminates the possibility of such interruption of the work as might be experienced were the loading platform in the street.

The work done with the six motor wagons is ordinarily equal to what would be accomplished with 12 wagons, but this does not represent the greater radius of movement possible, the elasticity to the service in the event of need, nor the possibility of meeting the natural increase of the business without additional equipment. The cost of the motor wagons was $6980, the first Cadillac being $700, the first Ford $900, the second and third Fords $640 each, the White $2600 and the second Cadillac $1500.

To equal the work of the motor vehicles it would be necessary to have 12 animal wagons, which would cost, taking the figures of 1910 as a basis, the following:

Investment.

12 wagons at $200 each	$2,400.00
12 horses at $175 each	2,100.00
12 sets of harness at $30 each	360.00
Total	$4,860.00

Operation.

Stable help	$900.00
Feed	1,829.04
Wagon repairs	342.00
Harness repairs	107.60
Shoeing	469.32
Total	$3,647.96
Wages, drivers, helpers	8,640.00
Total	$12,287.96
Interest on investment at 6 per cent	291.00
Total	$12,578.96

The records of the company are very accurately kept so far as the expense of operation is concerned, and while the price for gasoline will be somewhat increased as compared with the cost for last year, on the basis of the work for 1912, which is under consideration, the machines have made a remarkable showing. This is applied to actual results in dollars and cents, and does not comprehend any of the advantages that are obvious to the reader. The statement for the year specified shows the following:

Investment.

One Cadillac wagon at $700	$700.00
One Ford wagon at $900	900.00
Two Ford wagons at $640	1280.00
One White wagon at $2600	2600.00
One Cadillac wagon at $1500	1500.00
Total	$6980.00

Operation.

Miscellaneous repairs	$887.54
Tires	704.41
Gasoline at 15 cents a gallon	700.00
Oil at 40 cents a gallon	73.41
Total	$2365.36
Wages, drivers, helpers, etc.	5280.00
Total	$7645.36
Interest on investment at 6 per cent	418.80
Total	$8064.16

It will be seen that the cost of operating the six motor vehicles was $305.94 less than the expense for the eight wagons, and these are actual figures. Taking the horse equipment that would do the work of the six machines it will be seen that there is a difference of $4514.80 between the cost of the machines for 1912 and

the expense determined by an average of the cost a wagon for 1910.

It will be noted there has been no depreciation charged against either animal or automobile equipment, but taking both on the basis of 20 per cent., which is the general allowance, this amounts to $1396 for the latter and $972 for the former, or a difference of $524 to be charged against the motor equipment. There is a balance of $4574.80 in favor of the motors, and deducting the difference in a depreciation charge there is still $3990.80 to be credited to the motorized delivery. As a matter of fact the actual ratio of depreciation may be regarded as problematical, for the machines are excellently kept and ought to give a very satisfactory service for the period given, but under any circumstances there is a sufficient margin to justify the allowance of even 25 per cent. to be certain of being within the figure. The repair cost is minimum, for the work on the machines is done by mechanics employed at the laundry and no record has been kept of the labor performed by them. This is regarded as a part of the work incidental to the upkeep of the establishment. The labor cost, however, it is stated by Manager Haas, will amount to a comparatively small sum.

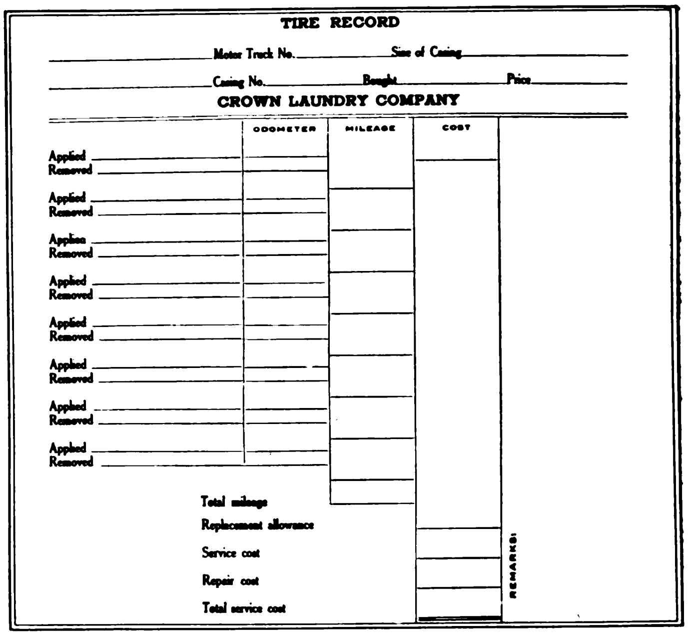
The installation of the motor service made it possible to provide for patronage from all parts of the city. It has been used for more than a year and during that time the development of the business has been material. The drivers of the four light machines collect and deliver and have the help of "jumper boys," but the White and large Cadillac machines each have drivers. The work done with each machine is represented by the record for each route, but this is provided for in the regular accounting, and aside from the pay roll the other detail is included in the blank filled by the driver. This states the total distance driven in miles, the gasoline used, the oil consumed, the punctures or blow-outs, if any, and the number of the casing, the number of the casing used for replacement, the speedometer readings and remarks. This is dated and signed by the driver.

Care is taken to maintain a complete record of each tire. A sheet is devoted to each shoe, giving the make of vehicle, its number, the size of the casing, the make, the number of the maker, the date bought and the price. Note can be made of eight installations and removals, the odometer record for each period of service, the period mileage, the total mileage, the replacement allowance (if any), the initial cost, the service cost, the repair cost and the total service cost. The quantity of fuel consumed will be about 4700 gallons a year, and on the basis of experience 200 gallons of oil will be a very liberal supply.

It is not possible to accurately determine the consumption of fuel or lubricant by average, for, to illustrate, in January, 1913, one Ford on a suburban route was driven 9.9 miles to the gallon of gasoline and 147 miles to the gallon of oil, while a similar machine in general delivery, making shorter runs, was driven but seven miles to the gallon of gasoline and yet made 237 miles to the gallon of oil. During this same period the White machine was driven 6.5 miles to the gallon of fuel and 336 miles to the gallon of oil, and the larger Cadillac for seven months averaged seven miles to the gallon of gasoline and 168 miles to the gallon of lubricant. The old Cadillac made 7.6 miles to the gallon of fuel and 86 miles to the gallon of oil. The White machine, however, being the largest and heaviest of the equipment, does the hardest work, and it is in some classes of service rated as being equal to six horses and wagons.

Relative to tires, different makes have been tried to determine what will give the best service, and during one period 36 casings were driven 87,839 miles, or an average of 2440 miles each, at a total cost of $726.70, an average cost of $20.18. These cost figures are based upon the replacement allowance when the shoes did not yield the guaranteed mileage.

Besides the economy of the service a substantial value can be placed upon the use of the vehicles, and this is of material importance when the development of the business is considered. Prompt service is another potent factor that cannot be underestimated.


TIRE RECORD

Motor Truck No. ____ Size of Casing ____

Casing No. ____ Bought ____ Price ____

CROWN LAUNDRY COMPANY

	ODOMETER	MILEAGE	COST
Applied / Removed			
Applied / Removed			
Applied / Removed			
Applied / Removed			
Applied / Removed			
Applied / Removed			
Applied / Removed			
Applied / Removed			
Total mileage			
Replacement allowance			
Service cost			
Repair cost			
Total service cost			

REMARKS:

Tire Record, Printed in Black on White Paper, 7.5 Inches Length and 8.25 Inches Width, Padded. These Records Are Kept for Each Casing.

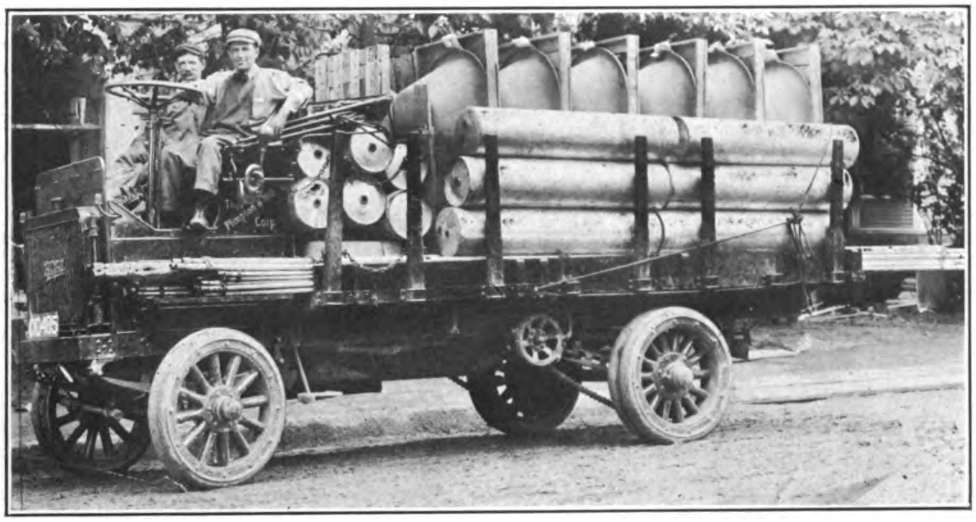
In building a section of the local sewerage system the Prendergast Construction Company of St. Louis has used a two-ton Dorris truck, made by the Dorris Motor Car Company of that city. All the material for the cement work, etc., has been hauled with this vehicle, which in addition to carrying its rated load has towed a big dump wagon carrying 7500 pounds and utilized as a trailer.

The Avery Company, Peoria, Ill., will build this year three sizes of tractors, 12-15, 20-35 and 40-85 horsepower ratings. The smallest and largest machines are new and the other was produced last year.

TRUCK ECONOMY IN CITY DELIVERY.

THE experience of the firm that utilizes a single motor vehicle in connection with animal service, and develops methods of use that satisfactorily economize, is always interesting. The cost of operation of one machine is relatively more expensive than several and usually the lack of facilities that would be possible or practical with the larger installation limits the productiveness that might be realized.

The Plimpton & Hills Corporation, Hartford, Conn., placed in service in May, 1912, a three-ton Pope-Hartford truck with a view of experimenting it in comparative work with horses, and used it in all forms of transportation. The company deals in plumbing and steam fitting supplies at wholesale and its customers are scattered throughout the city and its suburbs. With the increase of business and the demands of patrons for expeditious delivery horses were found to be hardly adequate and an investigation of the cost showed a surprising expense. It was estimated a truck would be the equal of five horses and on this basis an analysis showed that the expense for animals was larger than was believed.



The Pope-Hartford Three-Ton Truck Used by the Plimpton & Hills Corporation, Hartford, Conn., with Body Fitted for Carrying Plumbing Supplies.

The feed bill of the concern for a year was $1825, to say nothing of other cost that brought the expense up to a figure that was thought excessive. Good care was given the animals, they being under the supervision of a member of the firm. The belief was that the expenditure would increase rather than decrease and it was decided to buy a truck. Having determined what machine would probably serve the best and selecting that of local make because of the business relations with the maker as well as the possibility of obtaining service when required, the company determined to maintain its own business policy with reference to the vehicle.

The usual practise is to depreciate a truck at the rate of 20 per cent. a year, this giving a valuation of 80, 60, 40 and 20 at the expiration of the fourth period, this showing the loss of the entire price at the end of five years, but the company has accepted it as a part of the equipment of the business and not a separate item of expense. For this reason 50 per cent. is charged off to depreciation the first year, and each subsequent year 50 per cent. of the previous year's valuation is subtracted, which gives a reduction of 50, 75, 87.50, 93.25 and 96.63 from the original price, leaving a valuation of 3.37 per cent. at the end of the period. While it is estimated that the truck will last about five years, and while the result does not materially differ so far as the actual depreciation is concerned, it does materially reduce the valuation of the actual investment in the machine the last three years of its use, and, if it is well maintained, as undoubtedly it will be, it is probable that there will be a greater economy than would be shown in the statement as given. It will also be noted that while the policy brings the cost of operation high the first year, it decidedly reduces it each following year. Interest on the investment is also charged to the firm's equipment rather than to the truck specifically. The members of the company state that it is believed that at the end of five years trucks will be so improved that even with a high standard of maintenance it will be well to make a change.

The work for the truck is transporting heavy and bulky material, something like 20 tons being handled each day. The loads are made up of bath tubs, iron sinks, steam and hot water boilers, radiators, tanks, furnaces, pipe, fittings, etc., and stock that is frequently of considerable weight. The custom is to make up a load and send the machine so that there will be but little unproductive mileage, although in some instances loads are sent to a single customer. The orders are often delivered to the places where work is progressing, and at the prevailing rates for plumbers' and steam fitters' wages a prompt delivery promotes patronage.

The average daily mileage is 35, and in the time the machine has been in service it has been driven about 11,500 miles. During this period it has not been withdrawn for repairs. The work has been practically within the city, for hauls beyond the city's boundaries are discouraged. The firm still has several horses in use, but it is purposed to dispose of these and install another machine. The change will perhaps be made this spring.

The cost of operation for the first year, which includes the depreciation charge of 50 per cent., is computed at $11.96 a day, and it is maintained that the

truck will do the work of at least five horses, so that it will be seen that the economy is considerable from this point alone. The intention is to keep the machine on the road so far as this can be done, which the mileage will demonstrate, and the driver, who has a factory training and understands trucks thoroughly, has a helper. Both men handle the freight and in this manner the loading and unloading time is minimized. The driver gives the truck whatever attention is necessary, and he is expected to keep it in operative condition. The company believes that it is well to have a thoroughly competent man in charge of the machine and have him responsible for its operation.

The truck is equipped with a body especially adapted for the work, there being racks on either side for carrying pipe, which equalize the load and lessen the length that would be necessary were loading space wholly behind the driver's seat. The truck is kept in a garage built at the plant in Jewell street. During the past winter, as the temperature has been seldom very low, a somewhat unusual custom has been followed. When the machine is brought to the garage at night the water is drawn from the radiator and the motor and before starting in the morning the cooling system is filled with hot water. This insures against freezing and at the same time makes starting comparatively easy.

WANT TRUCKS BUILT IN NEW YORK.

Merchants' Association Urges Advantages of Metropolis for Vehicle Building.

The Merchants' Association of New York at its last meeting listened to discussion as to the advantages of New York for motor vehicle manufacture as compared with other cities of the nation, comparison being made particularly with Detroit. The industrial bureau of the association, of which Henry Morganthau is chairman, has sent a circular statement to those engaged in the industry in which is set forth at length the reasons why New York is, as the commercial centre of the nation, a better location than western cities, from the viewpoint of the committee.

The labor, housing, local transportation, the shipping facilities, banking and other conditions were compared, and it was maintained that with reference to factory locations, proximity of raw materials, highly skilled labor, liberal banking policies and with a market of unequalled proportions, New York had many advantages that should appeal to the business man. It is held that a third of the population of the country, and a market that is greater in proportion to inhabitants than in any other section, is within 400 miles of New York, and as it is believed necessary by every manufacturer to locate an office, and a service station if the business transacted is of material proportions, in the metropolis, it would be good business judgment to have the manufactories where they could give the highest character of service. It was pointed out that with the cost of railroad transportation increasing it would be logical for the manufacturers to have assembling plants in New York and send the parts there for the construction.

It was estimated that from 50 to 65 per cent. of the service wagons used in the United States are in use within 100 miles of New York, and with the improvement of traffic conditions in New York, which is to be expected within a very short time, the demand for these vehicles will greatly increase. So far as exportations are concerned, it is believed that it will be cheaper from every point of view to ship from New York, and shipment may be made for the Pacific Coast cheaper when the Panama canal is completed than by railroad. The completion of the New York barge canal will also cheapen the cost of transportation of raw materials.

SUMMER MEETING OF THE S. A. E.

British Engineers to Be Guests of American Organization in May and June.

Much interest attaches to the summer meeting of the Society of Automobile Engineers, which will take place on the steamer City of Detroit III during a voyage from Detroit to Sault Ste. Marie and return June 4-7. In connection with the meeting will be the formal entertainment of members of the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders of England, who will be present as guests of the society, and who will participate in the presentation and discussion of professional papers. There will be four professional sessions of the society and there will be entertainment, sports and recreation.

The English visitors will arrive in New York about May 26 and will be entertained by the society and the Metropolitan Section until May 28, when departure will be made for Pittsburg, where one day will be passed. May 30 the Speedway motor car races at Indianapolis will be seen and the second day given over to visits to the automobile factories in that city. Detroit will be reached June 1 and the programme calls for visits to several of the automobile factories and differing forms of entertainment, with a banquet at the Pontchartrain the evening of June 3. Returning from the steamer voyage, June 8 and 9 will be passed at Cleveland and June 10 at Buffalo, where the visitors will divide, some to return with the S. A. E. members to New York, and others to make a visit to New England, where they will go through some of the principal factories of Providence, Hartford, New Haven and Bridgeport.

KisselKar on Pacific Coast—The Kissel Motor Car Company, Hartford, Wis., has delivered a 50 horsepower KisselKar police patrol wagon to the city of Stockton, Cal. In test this car was able to develop 46 miles an hour.

The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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SYSTEM THE KEYNOTE OF ECONOMY.

The value of system has always been understood. The one great obstacle to its application has been inability to realize possibilities and the unwillingness of many to abandon methods that have been the vogue. The success of many of the great industries has been through the utilization of products that were once considered waste. Others have profited largely through the increase of production without greater expense for producing aside from material. System as applied to transportation means economy in just the same sense. The best examples are not always found in the large enterprises, although these are perfected organizations, for often conditions will not permit the most economic uses. Frequently the deliveries of comparatively small firms are admirably developed, and demonstrate that with even no material change in facilities, but with judiciously conceived methods, a large saving can be made. The reason for this measure of success is a careful study of possibilities and adaptation of use of equipment to realize them to the fullest degree. The man who measures motor vehicle service by accurate knowledge of cost of performing work with differing methods of transportation can economize, but he who bases his judgment on assumed standards is absolutely without facts to guide him.

THE VALUE OF EXPERIENCE.

Those who desire information relative to the possibilities of service from motor vehicles have the option of basing judgment upon their own limited observations and uncertain opportunities for acquiring material facts, or depending upon those who specially investigate and carefully prepare data that will be useful to those in the same lines of transportation. The trained investigator is a specialist who can always reflect the value of a method or system, and when statements are made that demonstrate possibilities through specific application, and are without any other purpose than to emphasize practical results under given conditions, it can be assumed that these can be relied upon.

Experience reflected by those who are competent to judge because of careful investigation of systems and facilities that are regarded as efficient and productive is always worthy of consideration. It is not expected that methods and policies can always be adapted to another service, but the knowledge of how capable business men deal with transportation problems ought to be suggestive of ideas that are or may be made valuable. Generalities and theories are worthless, but practical experience, when it can be obtained with comparatively little effort, can be valued according to the type of man seeking it.

RECORDS OF TRUCK SERVICE.

The owner of a motor truck or wagon who does not keep an absolutely accurate record of the work performed and the time required for it has no knowledge of the practical value of the machine. This does not mean that it is necessary to maintain an expensive system of accounting, but it is imperative to know what service the vehicle is giving, for no other data will inform him whether or not it is being worked extravagantly or economically. The man who places reliance upon the judgment of his driver to work a truck to its greatest value may have sufficient reason for so doing, but it is safe to assume if a man has such capacity there is little need for him to drive a machine.

If men who own motor trucks were to follow the work done by them for a few days and had intimate knowledge of the conditions in which they are used, they would have practical knowledge that would be invaluable to them, and which might be worth a great deal of money. The man who knows the details of his business, who can judge from the reports made him the productiveness and conditions with regard to administration, has his affairs well in hand. Such men seldom relax their command or control. It is imperative that this same degree of careful supervision be exercised with reference to the delivery and haulage. But to undertake to judge without facts is fallacy.

Where large number of machines are in use the record is considered necessary, but exact data are even more imperative with the service of a few wagons because the economies may not be relatively as large. And the wider the experience the greater will be the opportunities for applying methods that will be productive. Exact knowledge is a large asset in business.

TRACTORS A BIG SAVING IN LUMBER TRADE.

Equipment of the George W. Gale Lumber Company, Cambridge, Mass., of Five Electric Machines, Utilizing Wagons as Trailers, Shows Remarkable Economy---For a Period of 189 Days Three Did the Work of 17 Horses Each.

By William W. Scott.

DISTRIBUTION is one of the largest problems with which lumber dealers and manufacturers have to deal. Wherever possible yards and manufactories are located on or near railroads and water fronts, where shipments of stock may be received in large quantities, for lumber is always bulky and heavy, and handling is an item of material expense. Buying is generally on a free-on-board basis, and transportation charges are no inconsiderable part of the cost when received at the yards. As shipments are either by carload or cargo economy has always been considered in yard location, but until the possibilities of motor vehicles were realized but little attention was given to the delivery cost.

The limitations of animal haulage have long been understood and yet there are few concerns that can give even approximate cost of delivery. The custom has been to charge a yard or mill price and to add to this whatever has been decided as a cost sufficient to meet an estimated expense. The business of the average lumber firm varies according to the season of the year, and at times the demands are such as to require perhaps double the number of conveyances. This condition has necessitated either the maintenance of equipment that is not productive during a part of the year, or hiring additional horses and wagons whenever needed at an expense greater than would be realized with those constantly maintained.

Battery-Driven Tractor Built by Owner from Couple-Gear Components to Meet Special Service Needs, Drawing Horse Wagon as Trailer.

This variable character of the business differs according to the local conditions, and it is at times more strongly manifested than at others, but as a rule with horses and wagons or drays when the demands for delivery are the greatest there is, because of numerous considerations, a lessened capacity. This applies especially to hot weather, and when the hauls are long the horses must be favored. Lumber is not easily handled and is sold in greatly varying dimensions. In building operations large quantities are often required, so that for economy it is desirable to carry loads as large as possible

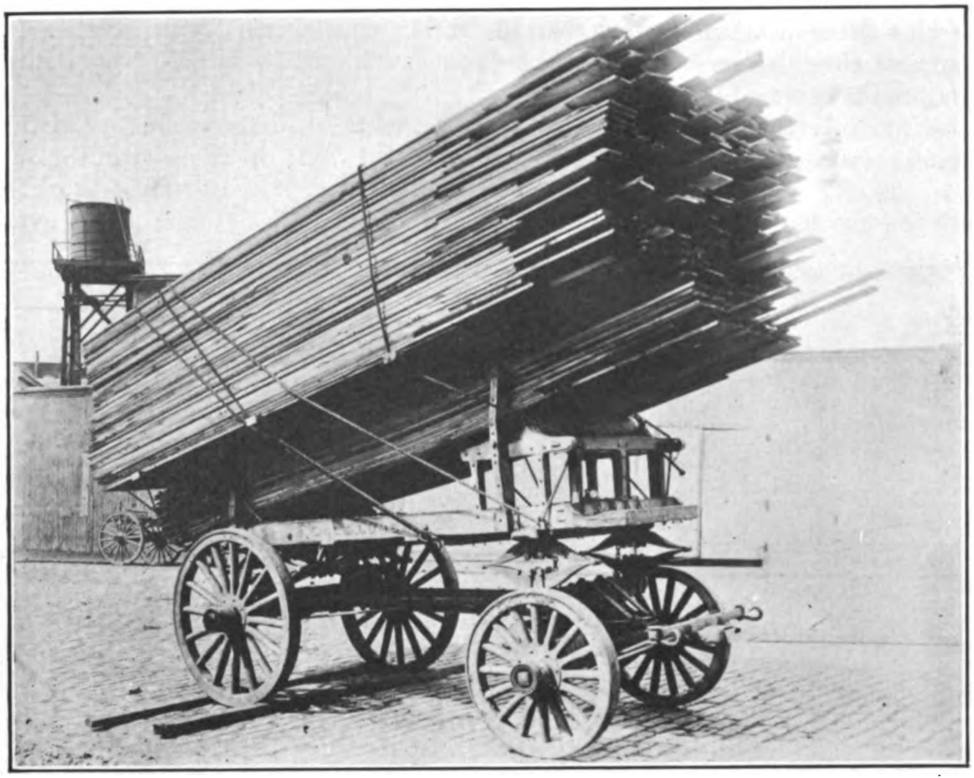
While wood varies greatly in weight it may be practical to average the soft grades at two pounds to the square foot. As it is usually sold by the square foot, an inch in thickness, loads are generally stated on the basis of 1000 feet. Or, to put it another way, board measurement is the rule by which lumber is bought and sold. Under ordinary circumstances yards are devoted to one class of stock, either soft or hard wood, and as some of the heavier grades will run as high as five pounds to the foot it should be understood that the statements in this article will, so far as weights are concerned, refer to the softer and lighter varieties.

The greater part of the haulage of lumber in this country is by horses, and while the capacity of the animals may vary considerably, it is entirely reasonable to give some idea of what may be regarded as average work. For instance, the daily mileage is approximately 15, and a good day's work for a horse is moving 15,000 feet of lumber one mile, or its equivalent, such as hauling 5000 feet three miles. Taking 1000 feet as weighing a ton this equals 15 ton-miles for the day. It should be understood that this is a capacity figure and cannot be attained unless the animal is worked constantly and with careful judgment. There are times during the year when this average will not be reached, and it will seldom be exceeded.

Many lumber firms have for years used with horses extra vehicles of differing types, and the reason has been to economize the cost of yard loading. Some have found that additional wagons can be loaded and left at the platforms or sheds or piles, and by changing the teams when they return to the yards from the

empty to the loaded vehicles the time lost has been not more than from three to five minutes. Where the wagons are unloaded there is always delay unless the equipment is fitted for discharging by gravity. For more than a score of years some lumber companies of large proportions have utilized wagons designed for gravity unloading, these having wooden rolls mounted in the frame to carry the load, the forward roll floating and the rear ratchet retained, and the front roll elevated so as to give an inclination of from 15 to 20 degrees to the load.

These wagons often have such a degree of inclination that in loading it is necessary to elevate the rear wheels on temporary blocking until the load is bound, which is done by rope or chain. Other types have the level platform with a series of floating rollers and a rear roller operated by a crank and retained by a ratchet. These are loaded without blocking and the load is bound by chains. In unloading the inclined type the load is allowed to slide backward until the rear end rests on the ground, when the animals can be driven forward and the other end dropped. With the chain bound loads the lumber is carried backward until the rear end drops to the ground, and then the wagon may be driven off.



Quick Discharging Wagon Loaded with 10,000 Feet of Lumber, Weighing 10 Tons, Drawn from Yard into Street by Horses to Economize Time of Tractor.

It will be understood that the economy of quick loading and unloading is known and has been provided for by concerns with large delivery equipment, and it may be said that such wagons may be procured at an expense of from $350 to $400 each. Of course such equipment can only be used with rough stock and finished work must be handled carefully to prevent breakage and staining.

The load that may be carried on the wagon with the inclined frame may be of greater length than that on a regular platform as it may be extended forward a considerable distance, as much as 10 or perhaps 15 feet beyond the seat of the driver. This is a decided advantage, because it is possible to carry longer stock than with the other type and the driver can see whether or not he can clear obstructions or move in traffic more or less congested. With such wagons timber 40 or even 45 feet has been carried, and with the load very evenly distributed. Very large timber is transported on what is known as reaches, with the load connecting the front and rear wheels. When unloaded the wheels may be brought together and the axles coupled by a metal or wooden reach that may be graduated as to length by moving a pin coupling.

The statements as to the vehicles have been made to demonstrate the use of animal wagons adapted for economizing time, and to show that some of the lumber dealers have utilized these to good advantage. Wagons fitted with the bodies and frames of the inclined type and intended to economize time so far as was possible, were used by the George W. Gale Lumber Company, Cambridge, Mass., a score of years ago, and yet with these it was realized that the cost of delivery was increasing because of the greater expense for drivers, maintenance, overhead, etc., and in that there were limitations to the work that could be performed.

In 1907 Vice President F. D. Sterritt, who is the yard and mill executive, gave attention to motor trucks and for practically two years he studied conditions and the work that might be accomplished with trucks. While it will be admitted that the information at his command was limited, and trucks in use at that time were nothing like the carefully developed machines of today, he was not impressed with the vehicles then available, especially as he desired to continue to use the 20 wagons, all in excellent condition and representing from $7000 to $8000 that would be sacrificed. While he was by no means certain what might be done with trucks for delivery the immediate need was to haul lumber between the dock and the yard, a mile distant. While the larger part of the stock is brought in by railroad cars, cargoes frequently arrive by vessel, and these are hauled as rapidly as possible because of numerous reasons.

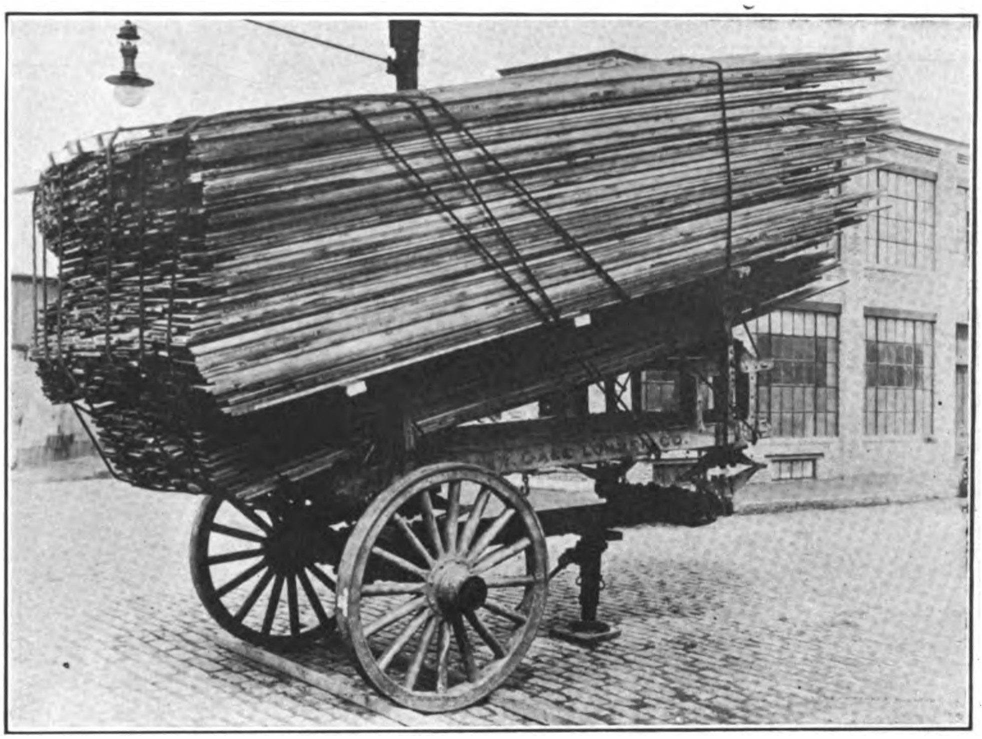
With this form of haulage 50 per cent. is unproductive, and with the limit to capacity and speed of the animals the purpose was to devise transportation that

would carry more or carry loads faster than horses, or perhaps have productiveness in both respects. In the autumn of 1909 a Couple-Gear battery tractor was delivered to the firm, this being the first machine of the kind sold in the vicinity of Boston, and this was the standard type of construction. The wagons owned by the firm are smaller than those used with tractors of this size, which necessitated some changes to adapt the machine to the work it was to do. The battery cradle of the tractor was underslung and side loading and the rear axle was mounted on heavy semi-elliptic springs.

The problem was to adapt the rear end of the tractor so as to make possible the use of the wagons as trailers without impairing their serviceability with horses, and as these were fitted with full elliptic springs at the front and rear it was believed practical to eliminate the tractor's rear springs. Accordingly the chassis frame was shortened to the rear of the battery cradle and the springs removed. A heavy cross frame member was placed at the rear end of the chassis frame and in this was made a round hole about 1.75 inches diameter. A large steel plate was cast with a double web beneath it, forming a channel to take the rear axle, and at the forward end was made a round lug that fitted the hole in the steel frame cross member. The rear end of the plate was extended back of the axle in half-elliptic form, and in the centre was made an 1.25-inch hole. This plate was secured to the axle and the axle was fitted with heavy radius rods extending to the lower rear ends of the battery cradle. The frame of the tractor was stiffened by trusses to the rear axle and on the frame of the chassis was built a box to carry the battery, this being extended both forward and rear, the forward extension forming the seat for the driver, and that at the rear being a tool chest. The brake linkage was not greatly changed at the rear wheels.

When the tractor was completed the body and frame of the chassis ended at a point about 20 inches forward of the rear axle, and the steel plate referred to extended about a foot back of the rear axle. The purpose was to have a support for the turntable or fifth wheel of the horse wagon, and to have sufficient clearance forward of this to permit turns to be made at 60-degree angles without difficulty. When the tractor was converted it was used by loading a horse wagon, jacking the wagon at a point back of the front cross members, backing the tractor so the extension of the plate on the rear axle was beneath the turntable, and lowering the wagon and coupling it to the tractor by a pin that took the place of the king bolt.

Mr. Sterritt was desirous of having a construction that would endure and the change was made under his supervision by the mechanics employed by the company. It was decided to use two batteries to have sufficient power for all requirements, and to charge the batteries a small generator and a gasoline engine was installed. This engine was designed for heavy duty and aside from cleaning and lubricating but little attention was needed. It was considered that this method of generating energy would be more economical than purchasing current from the city mains. At that time the company had in service more than 40 horses which were utilized for delivery, and the tractor was used for hauling the cargoes, and during the spare time between shipments was worked on the long hauls. Its service was begun Dec. 1, 1909.



Wagon with 10-Ton Load Jacked and Front Wheels Removed, Ready for the Tractor to Be Backed Under It and Coupled by Simply Inserting a Pin.

No careful record was kept because the construction work was done under such circumstances that it was not practical to differentiate the labor on it, but the general cost was approximated aside from this item. The machine was garaged in the basement of the mill building and in what was a machine shop, and here was located the charging panel and the engine and generator. This was sufficient for the immediate needs. Because the batteries were carried on the chassis it was necessary to hoist these out and in, which was done by a comparatively inexpensive fitting.

The machine was experimental in the reconstructed form and it was found desirable to make a change or two of minor importance to meet requirements that

had not been foreseen. It gave such economy in whatever work it was used that Mr. Sterritt tested it to what might be regarded as an extreme, on one occasion sending it on a 60-mile trip, carrying both batteries so as to make the distance without stopping for a "boost." In the work of hauling between the dock and the mill the tractor traversed the mile unloaded in from seven to eight minutes, and loaded in an average of 12 minutes, this being at rates of about eight miles light and five miles drawing a trailer carrying from seven to 10 tons. The time required to change the tractor from the light to the loaded trailer at either end of the haul was found to average about four minutes. This change was made by blocking the rear wheels of the trailer and lifting the forward end by the jack, when loaded, or by placing a horse under the reach or perch of the trailer and lifting the turntable with a pinch bar when light.

The installation of the first tractor cost the price of the machine, plus the reconstruction, the gasoline

Gasoline-Electric Tractor and Trailer Carrying 10-Ton Load of Lumber at a Speed of Five Miles an Hour.

engine and generator and such other equipment as was necessary, but the wagons were utilized without change.

The estimate was made by Mr. Sterritt, after careful observation of the work of the tractor under varying conditions, that it was the equal of eight horses, and this without considering the elasticity of its service. The tractor's battery was changed at noon, the battery removed being immediately placed on charge, and when the tractor was garaged for the night the battery it carried was charged without removal. This gave two charges and discharges each alternate working day for one battery, and one charge and discharge each alternate day, thus equalizing the work each had to do. The night charging was done by the watchman, the engine and generator requiring but little attention save lubrication, while it was ordered that the instruction of the battery maker be followed carefully.

The work of the tractor was so satisfactory that Mr. Sterritt decided to secure another, this to be used more in general delivery, and instead of buying the complete machine and reconstructing it, the parts desired were purchased from the maker and with these and those made from the patterns and dimensions used in the rebuilding of the first machine, the second tractor was built. The price of this vehicle was considerably less than the first, and the labor was practically performed by the company's machinist with such assistance as was necessary from men hired for the job. The actual cost of the tractor was somewhat difficult to determine because of the work being incidental to the regular demands upon the mechanic and the labor not always being accurately charged.

The tractor was practically in duplicate of the first and was placed in regular delivery work Nov. 1, 1910. With the use of this machine a garage was built in the yard, a substantial wooden structure with metal interior sheathing and a cement floor, and this was designed to house four vehicles. Because of the additional requirements for electrical current the gasoline engine was replaced by a steam engine and a 20 kilowatt generator, located in the basement of the mill building, and the use of commercial current was discontinued, the company making its own energy for lighting the plant as well as charging the batteries. The steam was generated with the use of sawdust and shavings for fuel, and as the boiler also furnished power for the mill the cost of current was reduced to practically nothing. In fact, aside from the installation of the engine and the generator, and the incidental changes in the wiring necessary there was little expense in the change.

The service of the first machine did not reduce the horses materially, but with the use of the second a number of the animals were disposed of. The work of the tractors was so satisfactory that a third was decided on and this was built in practically the same manner as the second, the parts being purchased of the maker and assembled in the garage of the company. The experience with the first two made the work of construction and the cost less, and in April, 1911, this vehicle was added to the equipment and more horses were sold. Anticipating a probable increase in the machines the garage was added to and a series of four compartments was built, three of which will house a tractor and permit work around it, and the fourth was fitted as a battery room. This has a platform about

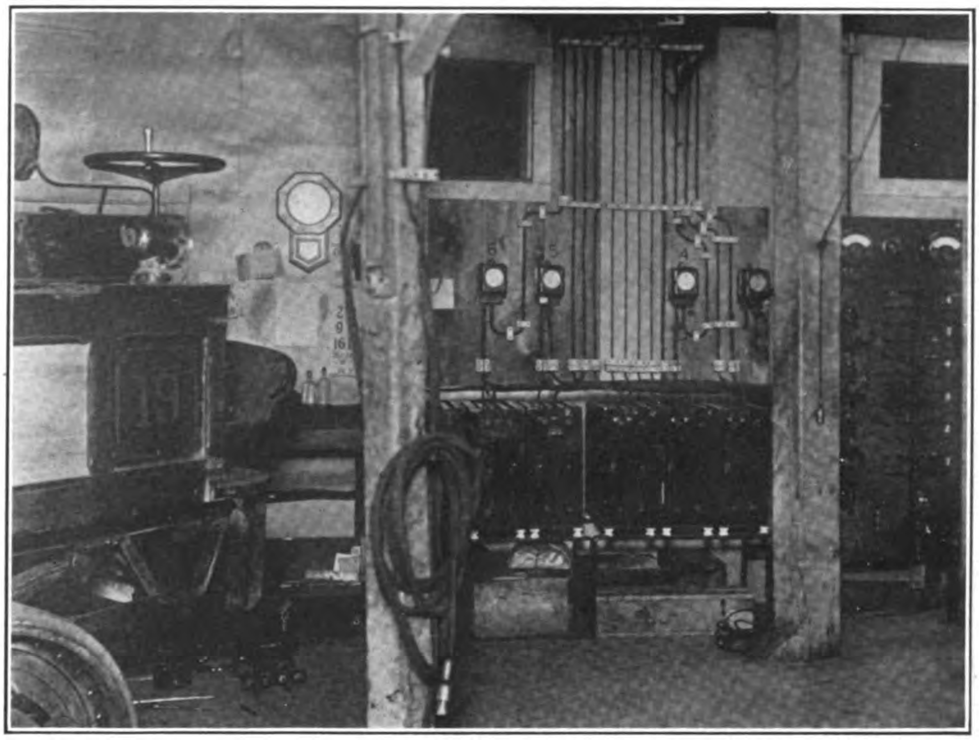
five feet in height at either side the width of a battery, and transversely across the room, about five feet above the platforms, are three steel girders that serve as trolleys and on which three chain hoists may be moved from one end to the other.

Between the platforms is a space sufficient for a tractor to be driven in and along either platform frame is a narrow bridge or shelf on which men may stand and work at the batteries, either on the platforms or in the machine. In the garage is a charging panel equipped for energizing six batteries simultaneously, and this and the six rheostats, installed on a low stand, require but little room. The current is received from the generator, about 100 yards distant. With the two sets of batteries it is possible to charge one from early morning, when the mill is started, until noon if need be, and the other from noon until the power is shut off, with the regular mill force. During the time when the day workers are absent from the mill the watchmen care for the fires and keep the power available. As a matter of fact, if needed, the generator can be operated constantly with practically no attention save lubrication, and the engine is equally simple.

The fourth machine was a gasoline-electric tractor, this being built in the same manner as the others, with parts purchased from the maker and with such modifications as were necessary to utilize the wagons, and it was designed, so far as the body was concerned, so that it might be transformed into a battery vehicle should there be any reason to make the change. With this the power is generated by a gasoline motor coupled to a generator and the motors are supplied with current so long as the engine is in operation. This went into service in May, 1912. Then the fifth machine was bought and as it had been used a short time, when reconstructed it was practically like new.

By the middle of the summer of last year the fifth machine, the second gasoline-electric, had been placed in commission, and at that time the number of horses was reduced to two. This represents the equipment of the company today, the five tractors taking the place of all the animals save the pair used for hauling wagons about the yard and placing the trailers where they can be reached with the least delay. As the mill yard was planned for horse delivery and it has been encroached upon by the increase of the business, so far as is possible the trailers are drawn into the streets, where the tractors are coupled, unless the loads are beyond the capacity of the animals. The horses are also used to haul the trailers into the sheds and to the piles, so that there shall be no delay with the work of the machines.

The five tractors as now used are doing much more than the work of 40 animals. There are seasons of the year when it is necessary for the drivers to work long hours to make delivery, especially when the hauls are long. The assignment of the machines is made by Mr. Sterritt, whose 30 years' experience has given him an intimate knowledge of routes and street conditions. During the spring and summer the drivers of the tractors frequently start working at 3 in the morning, and not infrequently they work as late as 9 in the evening. The orders to be sent out early are generally the longest on the books for the day and before the yard is closed at night at least 10 trailers are loaded and jacked, ready for the next morning. The drivers take the loads as assigned, and by the time they have returned from the second trips more trailers are ready for them, and in this manner the yard force keeps ahead of the trailer loading.



Charging Panel in the Garage of the George W. Gale Company, Equipped for Six Simultaneous Charges—In This Illustration Is Shown Tractor No. 19, Receiving Its First Overhaul After 52 Months' Service.

Each load must be carefully piled and bound and the stock in some instances selected. This work can be done rapidly by experienced men, but it is necessary to have the loads tallied, and so each crew must include a tally man. Were there 20 wagons loading a tallyman must check each load, and there would necessarily be a larger force of yard men. While it is true that the loads vary, this condition would obtain no matter what the form of transportation used, and where the orders are less than a load it is practical to combine several. Combination loads require more time in loading and unloading, but this condition is

one that must be dealt with to the best advantage.

In the hauls where the loads are large the trailers often carry 10 tons, but the average is seven tons. The tractors will move these at a speed of five miles an hour, or double the speed of the average horses, and carrying three times as much. Working overtime the tractors afford an elasticity of service that cannot be equalled with anything else than motorized equipment, and by changing the batteries and charging the spare sets whenever removed from the machines it is possible to keep delivery up to orders under practically all demands. With the gasoline-electric machines the capacity is approximately the same so far as load is concerned, but the radius of movement is unlimited, and the delivery may be made anywhere the customer may desire.

The gasoline-electric tractors are more expensive to operate than the battery machines from the fact that they consume both fuel and lubricant and there is the normal wear of the engine. While they are very enduring because of the heavy construction they are not expected to wear as long as the others, because of the vibration of the engine. When they were built it was with the expectation by Mr. Sterritt that he might eventually convert them to battery tractors, because he believes that there will be eventual improvement of batteries that will justify the change. He does not regard the engine-generator tractor as being as certain equipment as the battery tractor because of the necessary maintenance work that requires withdrawals from service for differing periods.

March 22 of this year tractor No. 19, the first placed in commission, and in its fourth year of service, was placed in the garage for its initial overhaul, and one of the accompanying illustrations, made two days later, shows a part of the machine. The wear shown was so slight that the tractor could have been assembled and might have been run for a considerable length of time, but Mr. Sterritt believed that it would be best to make a thorough job and in several instances holes in castings were bushed and relations accurately restored. Many of the hardened bolts showed practically no evidences of wear and but a very few of these were replaced with new. The cost of the work, aside from the labor, will be very slight. As the power wiring insulation had been attacked by the drainage of electrolyte new cable was installed, but this was the largest single item of expense aside from the labor. Considering that the tractor had been in use about every working day for considerably more than three years, and had been worked overtime sufficiently to make at least 30 extra days a year, this was a remarkable showing. But the machine had been given careful attention and was in no way neglected, despite the fact that it was worked hard.

Battery Room of the Gale Company's Garage, Designed to Afford Quick Exchange of Tractor Batteries, Usually Made at Noon Each Day.

Though there are five machines in the service practically no spares are carried, and the equipment of the garage consists of a few simple hand tools. An extra armature is the only insurance against motor trouble, and a change can be made in a comparatively short time.

Mr. Sterritt does not make a direct statement as to the cost of machines compared with the expense of the horse equipment he used, because of the conditions under which the change was made and that charges were not made of labor, for instance, by his own men, that might not be possible with others. He maintains that the best evidence of the possibilities of electric tractors in the lumber service is that he has completely motorized his yard, and it has the reputation, with lumbermen, at least, of being the best equipped plant in the country. He says that the current really costs nothing because of the wood refuse used for fuel, and that he frequently has inquiries as to his "secret" for generating power so cheaply. To visitors he shows the boiler room when this question is asked.

Mr. Sterritt has a problem that he occasionally propounds to his friends, and it is the result of the work of three tractors, two electric battery and one gasoline-electric, for 189 days, during which time the machines were driven 16,748 miles and carried 9,650,000 feet of lumber that averaged 1.5 pounds to the square foot. He maintains that a horse can transport 15,000 square feet of lumber one mile in a day, and he has asked his friends to determine how many horses would be necessary to accomplish the work of the tractors. The es-

timates volunteered varied from 36 to 1700 horses.

During the period, however, the average mileage was 29.543 daily, and the average load for each tractor was 17,019.40 feet. As the tractors were assumedly loaded half the distance the loaded mileage may be taken as 14.771, and taking the assumed horse capacity of 15,000 feet one mile daily as the base the work approximates what could be done by 16.75957 horses. This work was recently accomplished and it represents practically 27 weeks, or a sufficient length of time to demonstrate that it could be continued indefinitely.

Taking these figures it will be seen that the five tractors equal 85 horses, or at least the three machines for 189 days did work that would require 51 horses to do, and the cost of animals formerly used to the company, the accounting being accurate, was $1.37 each daily. The expense of maintenance of 17 horses would be $23.29, and the cost of the drivers would be at $2.50 daily, $21.25, or a total of $44.54, against which must be charged the cost of operation of a tractor and the pay of its driver, which may be taken as $12.50.

To demonstrate the efficiency of the tractors in another way: With horse equipment the cost of the animals averaged $275 each, a wagon $350 and double harness $50, or $950 for each two-horse outfit. Depreciation was figured at 20 per cent., which was excessive so far as the wagons were concerned, but was probably close to the loss on animals. The cost of maintenance, including stable, feed, veterinary, help, shoeing, repairs, renewals, was $1.37 an animal a day. Thus to operate a wagon and two horses six days a week cost, with the driver, $5.63 a day. It will be seen that this total is economical when contrasted with the usual estimate of $6 a day for a two-horse outfit. The stable was of considerable proportions and it occupied space that was later utilized to excellent advantage in the yard, this being valuable for storage of lumber that should be protected. There was a decided gain in utilizing this building for other purposes. The wagons are all utilized and will continue to be useful for a long period of time to come.

The cost of the original tractor, including the reconstruction, was about $6000. The expense of the others was less than this because of the manner of building. The garage is an inexpensive structure and its equipment is not costly. It will serve for many years. The installation of the motor generator and the lighting system reduced the expense for illumination materially. Power is generated with fuel that was difficult to dispose of and accumulated rapidly. Aside from the initial expense the cost of lighting is much below what it was when the energy was bought from a central station. The batteries require but a small part of what is used each day in the plant. Mr. Sterritt says that he would increase the proportions of his generating installation were he to plan it again.

Considering the economy of the tractors: Assume the tractors and the equipment necessary for their use represents $30,000. Referring to the work for the 189 days it will be seen they are as efficient as 85 horses, which would cost at $275 each $23,375. The wages for the drivers of 85 animals would be $34,710 a year, and against this amount must be charged the wages of the five tractor drivers amounting to $3900 for the same period, or a saving in wages of $30,810 annually, without taking into consideration the lessened expense for tally men.

As to expense for depreciation. This item may be said to be unknown as yet, but if the battery machines endure as has that which was operated for 52 months before it was overhauled, the charge of 20 per cent. is much too large. In fact it would seem that half that amount would be a very liberal estimate. This is a reduction of 50 per cent. over the depreciation allowed for horses. The gasoline-electric tractors may depreciate more quickly, but the ratio is problematical as yet.

The cost for batteries is provided for by a contract which calls for such care, attention and renewals as is necessary to maintain a stated efficiency. The experience with tires has been very satisfactory, considering the large loads carried, for the weight is largely on the steel tires of the trailers, and the full elliptic springs, the comparatively slow speeds and ease of acceleration minimize the strains and the wear.

The possibilities of the tractors have been stated on a basis of actual work accomplished. But there is another phase to be considered. The machines have been shown to be the equal of 17 horses each for a length of time to insure a thorough test, and it is not improbable that they could do even more than what has been given as an average should occasion require. But in the periods when there is the least service for them they cost but a comparatively small part of the expense of maintaining horses and there is no depreciation. Not only this, the serviceability of the animal is measured by its life, while the actual measure of the work of the tractor should be mileage, dependent, of course, upon its upkeep.

Taking the figures stated for the results of 189 days' work, indicating that the tractors are each equal to 17 horses, and assuming that each does but half the average, this is better than eight horses and four drivers. The cost of this equipment for maintenance and operation at $5.63 each for every working day would be $23.93, or practically double the expense for the tractor.

The delivery equipment of the George W. Gale Company has attracted attention from the fact that the concern distributes all of its stock, both rough and finished lumber, by motor tractor, and visitors very frequently go over the plant and observe the methods and the work of what has been characterized as the best motorized lumber yard in America.

The Boston branch of the H. J. Koehler S. G. Company, recently made a sale of five Koehler commercial cars for export to West Africa. Manager W. H. Shutt was informed by the purchaser that this was a sample order, the purchase of others being contemplated for use there on the veldts.

STREET RAILWAY BUYS 29 ELECTRICS.

New York Public Service Corporation Will Install Big General Vehicle Equipment.

The New York Railways Company, the public service corporation that controls the street, elevated and subway transportation of the metropolis for Manhattan and the Bronx, has purchased of the General Vehicle Company 29 electric wagons and trucks which will be used for differing works. Three of these will be 1000-pound wagons with panel bodies, one will be a money wagon on a 2000-pound chassis, five will be 4000-pound chassis fitted with bodies and equipment for emergency service, 14 will be 3.5-ton chassis with dumping bodies for use in general construction work, four will be 3.5-ton chassis with the standard stake platform bodies, and two will be five-ton chassis with standard stake platform bodies. This order will be delivered as quickly as the work can be sent out from the factory.

The power used by the railroad is electric and the electric current can be provided wherever the machines will be located, for it is intended that they will be located at different stations with reference to the needs. The statement is made by Sales Manager C. W. Squires, Jr., that the number of electric vehicles bought by public service corporations has increased greatly within two years, and it is expected that the total number of machines owned by such companies will reach the 1000 mark in a comparatively short time.

EXCLUSIVE ELECTRIC GARAGE.

New York Edison Company Liberally Contributes to New Metropolitan Enterprise.

The exclusive electric garage that has been promoted by the New York Electric Vehicle Association will, it is believed, shortly be realized, for the plans for its establishment have assumed a tangible form and the enterprise will be inaugurated with the co-operative support of practically all of the electric vehicle interests in the metropolis. There are in New York today two garages that are given over wholly to business wagon service. That of the Yellow Taxicab Company is in East 25th street and the Acme Electric Garage is in East 32nd street. These two will accommodate about 125 machines, which is but a small proportion of the number in the city, which is estimated at considerably in excess of 2000.

Many of these, however, are kept in private garages, but with the rapidly increasing number of small delivery installations there is believed to be a demand that will justify the establishment of a garage of large proportions. The purpose of the association is to have a station in which all kinds of electric vehicles can be maintained.

The New York Edison Company has made an appropriation of $30,000 to make possible the establishment of the garage, this to be available in equal amounts for three successive years, and it is expected that with this fund it will be possible to open a station that will afford the character of service that will attract and retain patronage, and be, with the co-operation of the numerous interests, quickly self-supporting. It may be that the garage will first be established, and the interested concerns will assist in its development, and that later the plan for the centralization of the business of the electric vehicle companies will be worked out.

The New York Electric Vehicle Association is a division of the Electric Vehicle Association of America, and it is understood that the expenditure of the fund placed at the disposal of the organization will be through the office of the national body. Arthur Williams, general inspector of the New York Edison Company, is president of the Electric Vehicle Association of America, and it is but natural that the company should be represented by him. In connection with the garage it is intended to decidedly increase the facilities for the use of the electric vehicle in New York.

CASE LEAVES LANSDEN COMPANY.

Move Disposes of One Set of Rumors and Brings to Light Another.

W. L. Case, vice president and general manager of the Lansden Company, Newark, N. J., maker of Lansden electric vehicles, has resigned his position and his place has been taken by George E. Blakesley. It is understood that Mr. Case has disposed of his holdings in the company and will return to his consulting engineering practise after a trip through the South.

The Lansden Company was established about 10 years ago to develop an electric truck utilizing the Edison nickel iron batteries. After the International Motor Company took over the Mack plants at Allentown, Penn., a number of those interested in the latter business formed a syndicate to buy the Lansden Company, and it was taken over in January, 1912, when Mr. Case, who had a considerable part in the formation of the International company, was placed in charge.

Mr. Case's resignation would appear to set at rest rumors which have been persistently circulated that the International company was to absorb the Lansden Company. That this supposition is without foundation seems to be further confirmed in the eyes of those interested, by the fact that Mr. Blakesley is said to be closely associated with John M. Mack, who although at one time a strong factor in the International company, has for the past few months been inactive in its management.

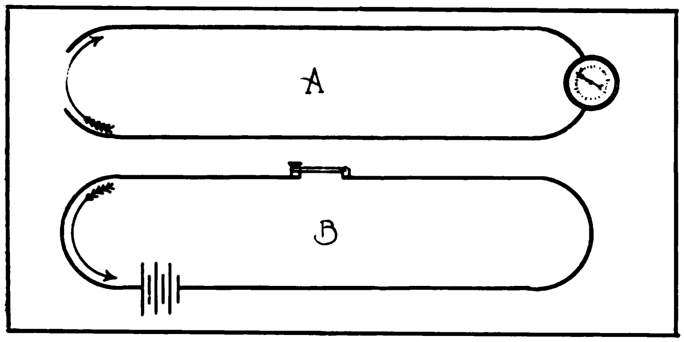
There is said to be some prospect of the formation of a new consolidation of the Lansden, the Mack and the Webb companies, all of which are owned by Mr. Mack and his associates. This possibility, however, has received no encouragement by those most intimately interested.

ELECTRIC VEHICLE PRACTISE.

The Principles Governing the Application of Current Electricity for Motor Propulsion, the Units of Electrical Measurement Ordinarily Used, the Theories of Design and Qualities of Common Motors and Dynamos

By William W. Scott.

THE simplicity of the electric vehicle is such that it is not necessary for the owner or operator to acquire technical knowledge, but it is desirable, because of their very general and constantly increasing use, that electrical definitions and units of measurement be understood. While electric activity may be classified as static and current electricity, the latter is the form with which the user of the vehicle will deal, and this is the continuous passage of energy from a point of high potential to a point of low potential, there being a constant source of electromotive force.



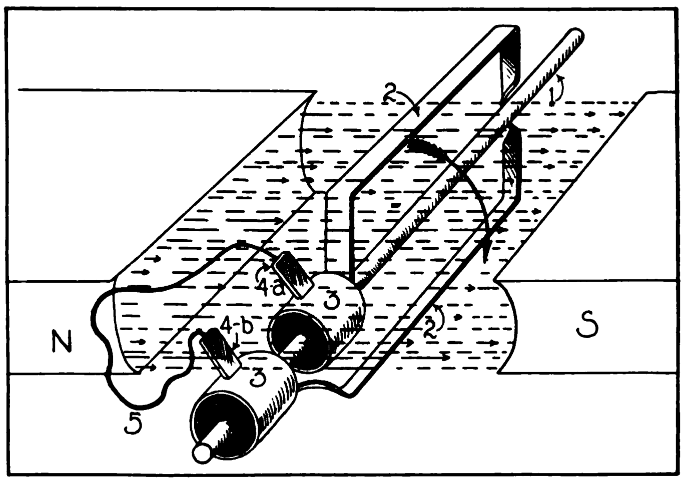
Inducing and Induced Current: A, Circuit Through a Galvanometer, in Which a Current Is Induced by a Current in B, Created by a Battery, When a Switch Is Closed—Arrows Indicate the Flow of the Induced Current Is in Reverse of the Inducing Current.

The electric energy utilized in motor vehicles is mechanical movement converted into electrical current, and in the operation of the vehicle this current is again converted into mechanical movement, the dynamo being the source of the current stored in a battery of cells, and the motor being the means by which the current from the battery is transformed into mechanical movement or power. It will be noted that the function of the motor is to reverse the operation of the dynamo, and this statement expresses precisely the characteristics of the two machines. But it is possible to operate a practical dynamo as a motor by simply changing the position of the brushes.

Mechanically generated electrical energy is a result of induction, and this may be explained by assuming a circuit of wire connected to a battery in which circuit is a switch that may be opened and closed, and a second circuit of wire that is through a galvanometer. When the first circuit is closed and the current moves from the positive to the negative pole of the battery, a weaker current will be induced in the second circuit, if within the range of influence, which will move in the opposite direction, but for a very brief period. If the battery circuit is then opened and the galvanometer observed, a second current will be noted, weaker and briefer than the first, but flowing in the opposite direction to that first seen. The strength of the currents will be proportionate to the strength of the inducing current, and to the proximity of the circuits. But if the circuits are sufficiently separated the weaker current will move in the same direction as the stronger. Again, a low resistance wire in the inducing circuit and a high resistance wire in the induced circuit will cause a greater electromotive force in the latter than in the former. Or this result may be reversed by the condition of wiring.

When polarity exists a metal may be said to have magnetic influence and there is a constant flow of current from the one pole to the other. The dynamo is a temporary magnet, and as built it has pole pieces between which an armature revolves, breaking or interrupting the lines of magnetic influence that are passing from the positive to the negative poles. The pole pieces of the motor are converted into electro magnets during the time the machine is in operation by a current sent through the windings of these pieces. The pole pieces are known as well as the field pieces.

The theory of the dynamo, so far as the principle of induction is concerned, may be observed in an accompanying drawing, which represents as N and S the north and south pole pieces of a machine, between which flows a current of magnetism from north to south so long as the pole pieces are magnetized. Between these is shown a shaft 1 on which are two segments 2 that, it will be noted, are connected with the rings 3 on the shaft 1. Contacting with the rings are the brushes 4 a and 4 b, from which current is taken through the cable 5 to the circuit in which it is used.

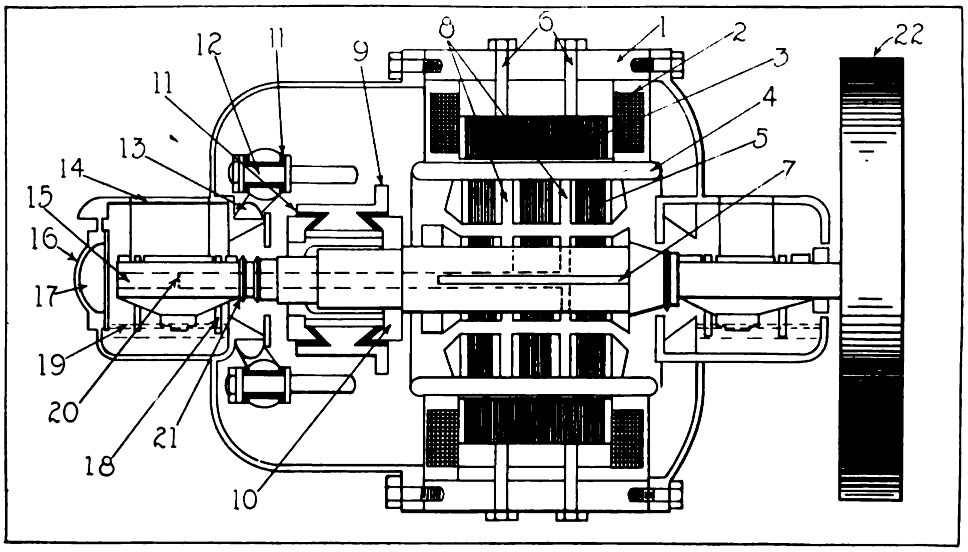


Sketch Illustrating Dynamo Functions: N, North Pole; S, South Pole; 1, Shaft; 2, Segment of Armature; 3, Collecting Rings; 4 a and 4 b, Brushes; 5, Current Supply Cable.

This form of dynamo would produce an alternating current. The shaft 1 merely carries the armature, which is represented by the segments 2, and the rings 3 are insulated so that the current is collected by the brushes 4 a and 4 b and carried off on the cable.

The armature in practise is made up of a large number of segments, and when it is turned the segments will cut or interrupt the lines of force or magnetism flowing between the north and the south poles. As shown in the drawing the segments are at right angles to the lines of force and at that point offer the greatest obstruction to the flow of the current, while they do not obstruct it when turned in the direction of the flow. With the revolution of the shaft the current induced in the circuit formed by the segments and the brushes and the cable connecting the brushes will be constantly changed in strength and direction as the segments approach and recede from the pole pieces. Because of this variance the current will alternate in its delivery to the cable and flow in opposite directions, rising from zero to maximum and subsiding to zero so long as the movement of the segments is continued. The current is changed to flow in one direction by the addition of a commutator. The description is intended to illustrate the principle only, for in practise the armature consists of a considerable number of segments and the lines of force are separately interrupted by each of these as the armature revolves.

The dynamo generates the electric power from mechanical movement and the motor reconverts it into mechanical movement. In construction they are practically the same, both having the field magnets in pairs or in multiples of two with opposed poles and the pole windings connected in series; the armature that revolves between the field pieces and interrupts the lines of force, the exposed ends of the magnet cores that form the pole pieces, the commutator that collects the current, and the brushes that contact with the commutator and serve as the terminals for the circuit through which the current is delivered.



Electric Motor, Shown in Longitudinal Section: 1, Magnet Ring; 2, Field Windings; 3, Field Magnets or Pole Pieces; 4, Armature Winding; 5, Armature Core; 6, Bolts Retaining Field Pieces; 7, Shaft Keyway; 8, Air Circulation Ducts; 9, Commutator; 10, Commutator Retainer; 11, Insulation; 12, Brush Stud; 13, Brush Rocker; 14, Inspection Plate; 15, Air Circulation Duct; 16, Air Filter; 17, Air Inlet; 18, Oil Rings; 19, Oil Level; 20, Fan; 21, Oil Distributing Rings; 22, Pulley.

The dynamos customarily used are series-wound, shunt-wound and compound-wound, but there are other types that are designed for special purposes, these varying as to the construction of the armature, the form of field windings, and in other detail with reference to the uses to be made of them. Of those specified the series-wound type are constructed with the two poles of the magnets wound with a small number of coils of a heavy low-resistance wire, one end of which is connected to one brush and carried around both pole cores and to the outside line and to the other brush. With the shunt-wound machines the pole cores are wound with many coils of a high-resistance wire, and the field windings form a shunt circuit from the main outside circuit, the terminals of which are the two brushes contacting with the armature. These brushes are connected with the terminals of the field windings. The compound-wound dynamos combine the construction of the two mentioned, the field magnets being double wound with a small number of coils of a heavy low-resistance wire, which is arranged in circuit as in the series-wound machines, and with a second winding that is identical with that of the shunt-wound dynamo.

While the pole pieces of the dynamo of the series-wound type are not magnets until excited by the electric current passing through them, there is generally a sufficient degree of energy retained in them, which is known as residual magnetism, to cause the generation of current as quickly as the armature is moved. That is, there remains in the pole pieces a slight magnetic influence that is moving from the north to the south poles, and these lines of force, when interrupted and directed through the field windings, will so intensify the current and the electromotive force that the dynamo can be started and will begin to generate current until the maximum of speed has been reached and the machine is producing the greatest degree of electric power. The statements made relative to the dynamo can be applied equally well to the motor, as will be explained later.

The units of electrical measurement are regarded as being as accurate as engineering science could devise and these are stated in what are known as the C. G. S. units, which represent length in centimeters, weight in grams and time in seconds, and they afford a means of accurately estimating the proportions of current strength, circuit resistance and voltage. It

may be well to point out that the units permit a very precise estimate of the power efficiency under given conditions on a given circuit, from the fact that the working energy available, expressed in amperes, is exactly proportionate to the voltage and resistance of the circuit and to the efficient activity in terms of work accomplished and time required.

The unit of resistance is the ohm, which is equivalent to the resistance to one volt of electromotive force by a column of mercury 106.3 centimeters in height and one square millimeter cross section, at a temperature of 39 degrees Fahrenheit or it is equivalent to the resistance of one foot of No. 40 B. & S. gauge copper wire. From these two standards it is possible to determine the resistance of any conductor with reference to length and cross section and to make accurate comparison of the resistivity of any conductors of differing dimensions.

The ampere is the unit of current and this has been established as the strength of current that can deposit .00033 gram of metallic copper, using the electro-plating process, in each second of time. It will be noted that this designates the intensity of the current, which may be taken as its working energy, as well as the time for a given work. From this basis it is possible to estimate the power for any period, though the phrase ampere as applied to electric vehicle work is often meant to express ampere-hours. The ampere-second is represented by the coulomb, which is technically used to express electrical volume, it being the equivalent to the product of the amperage of a current by the number of seconds of flow.

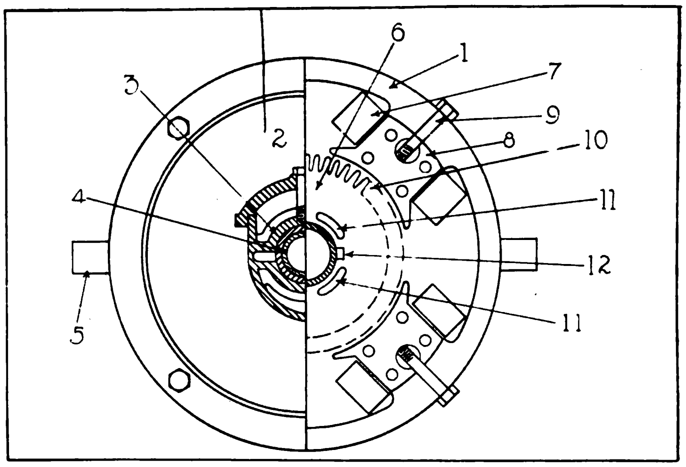
The volt is the unit of pressure and this is determined with the units of current and resistance. One volt of electromotive force can produce a current of one ampere on a circuit having a resistance of one ohm. This is the actual standard, and where voltage is stated it may be regarded as a known quantity, or it may be an equivalent estimated on the capacity of a type of galvanic cell. It is not necessary to define Ohm's law with reference to electric energy, for it has been sufficiently expressed to meet all requirements of those using or operating electric vehicles.

The unit of activity is the watt, which indicates the rate of energy of one ampere of current under a pressure of one volt, and represents the product of the voltage by the amperage. There are other expressions of the value of the watt, which may be the product of the resistance by the square of the current, or the quotient of the square of the resistance by the voltage. Generally the operative capacity of an electric motor is expressed in watts or kilowatts, and 746 watts is taken as the equivalent of a horsepower.

In the use of electric vehicles, however, there is seldom need for the accurate figures that can be obtained from these units of measurement. The voltage is determined by the voltmeter, the amperage by the ammeter, and the watts by the wattmeter. These indicating instruments are very accurate and dependable and of course vary with the use to be made of them, some on the vehicle and some in the garage in charging the battery.

The dynamo has been described because it is the source of production of the current, and the principles have been outlined that the generation of energy may be understood, but in the use of the vehicle the motor is to be considered. This machine is, as has been stated, practically the same as the dynamo and differs only in the position of the brushes. With the dynamo the residual magnetism is sufficient to excite the field windings and the pole pieces when the machine is started to generate current, and this current will in turn further energize the pole pieces and convert them into strong magnets.

But with the motor there will be also a residual magnetism, and this is augmented when the current is supplied to the windings of the pole magnets and the windings of the armature. The opposite poles of the armature are attracted by the magnetic action of the pole pieces and the armature is rotated. In the dynamo the lag of the current to a certain extent resists the rotation of the armature, but with the motor this becomes a magnetic drag that is the propulsive force, turning the armature and constituting the influence that the magnetic field exerts upon the armature wiring, through which the current from the line is flowing.



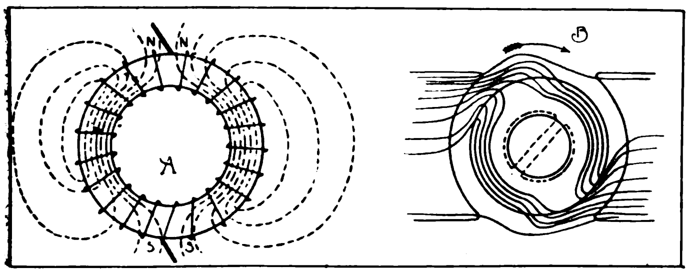
Four-Pole Electric Motor, Partial Section: 1, Armature Shell; 2, End Plate; 3, Armature Shaft Bearing; 4, Brass Sleeve; 5, Supporting Lug; 6, Armature Core; 7, Field Winding; 8, Field Pieces; 9, Field Piece Retaining Bolt; 10, Channels for Armature Windings; 11, Air Circulation Ducts; 12, Keyway.

As the armature is caused to rotate between the pole or field pieces, and the magnetic action assists that rotation, the interruption or cutting of the lines of force creates or produces a counter electromotive force, which is increased as the speed of the armature increases. This results from the strengthening of the magnetic field and the large number of lines of force created. But as the armature speed is increased there is a lessened resistance to its motion, and because of the greater counter electromotive force less energy is absorbed. As the load is placed upon the motor and the armature speed is retarded the counter electromotive force generated is less and there is a corresponding increase in the energy absorbed.

The electromotive force produced by a dynamo is

proportionate to the number of turns of wire wound upon the armature and to the speed of rotation within certain limits. As the rotation of the armature produces a series of reactions between the windings and the magnetic field, the armature is transformed to a magnet that is polarized constantly at certain definite points in its rotation. These points of polarity are, according to the accepted law of induction, at right angles to the lines of force, and as the neutral points are the points of contact between the brushes and the commutator, where the current leaves and re-enters the winding of the armature, the armature is constituted two separate magnets with two north and two south poles, each pair of poles being an equal distance from the contact of the brush. The two north and two south poles really serve as single poles and at the extremities of the diameter of the armature cause the distortion of the lines of force with the rotation of the armature.

The induced polarities of the armature, the one resultant from the induction from the field and the other from the induction from the armature winding, cause the distortion of the magnetic field, and the current moves from the north poles of the armature windings through the armature to the south poles, and thence



Movement of Lines of Force: A, Direction of Lines of Force and an Induced Current in the Polarizing of a Rotating Dynamo Armature of the Ring Type; B, Distortion of the Lines of Force Passing Through the Rotating Dynamo Armature.

through the pole pieces of the magnetic field to the north poles of the armature, forming currents moving in opposite directions at either side of the contacts of the brushes. The induced current in the armature moves at right angles to the direction of the inducing current in the windings. With the motor, however, the electromotive force moves in the armature in a direction opposite to the current. As before stated the current supplied to the circuit, influencing the windings of the motor armature and the windings of the pole magnets, causes polarity in both, and the magnetic action is attraction of the opposite poles of the armature, which exerts a propelling effect or driving force.

The power of a motor is proportionate to its speed and to the torque, which is the effective energy that may be exerted upon the pinion or gear secured to the end of the armature shaft and through which the driving effort is applied. This power is measured by pounds weight, the diameter of the pinion or gear and the number of revolutions a minute.

The qualities demanded of the electric vehicle motor are that it shall have a high efficiency though having low power rating, that it can be operated under different pressures and at different speeds, that it give service without fuses, cut-outs and other protections, and that power be produced uniformly under differing loads. In the operation of such a motor it is frequently required to endure an overload of several hundred per cent., and the protection that might be afforded with a machine used for other purposes would serve when the greatest work was necessary. The greatest power is required in climbing grades or on rough roads, and at times a driver will start at high voltage with a very heavy load or under conditions that will tax its capacity to what may be regarded as the extreme. The motor must have the greatest strength, be as light as it is practical to make it, and it must endure the stresses of operation with the least possibility of wear or damage. The accessibility of the motor is another important factor, so that the commutator and the brushes may be examined and adjusted, cleaned or repaired.

In the installation of the motor in the vehicle the connections made between the machine and the battery are always flexible, which is insurance against crystallization, short circuits, and other damage that might result from vibration. The rotating parts are always mounted on ball bearings and lubrication is provided for by oil wick cups or adjustable compression oilers. The motor is always enclosed in a substantial housing, usually a shell of steel, in which it is protected from the abrasive influences of dust and other accumulations.

The machines generally used for motor vehicles are the series-wound type, which form is regarded as being extremely efficient and practical as well as meeting with all ordinary requirements. One quality especially desirable is that it will automatically adjust the consumption of power to the load, consuming a small current with light loads, and as the resisting torque is increased the power needed for the work is constantly absorbed, so that there is high efficiency when the overload is very large. It will require more power when climbing grades, however, than will other types. In this type, as the total internal resistance is equal to the combined field and armature resistance, the current consumption is the same under an even load at any speed, and the torque is approximately proportionate to the current. When used with a light load and small current the speed of the armature is high comparatively, which, because of the creation of a high counter electromotive force, reduces the current supplied from the battery proportionate to the difference between the impressed voltage and the internally generated voltage. Thus, while the efficiency is lessened with light loads and at high armature speeds, with heavy loads and decreased armature speeds the efficiency is increased. This has caused the construction of machines that will produce power proportionate to the weights, and have comparatively slow speed of the armatures.

(To Be Continued.)

TRUCK ECONOMY IN COAL DELIVERY.

Six Electric Machines Installed by the John E. Cousens Coal Company, Brookline, Mass., Since July, 1910, and Maintenance of Regular Horse Equipment, Is a Striking Illustration of the Possibilities of Business Building.

ECONOMY of delivery is usually determined by a comparison of the cost figures so far as these may be known. The assumption is that each represents a satisfactory standard of measurement, and a statement or chart is believed to convey a clear knowledge of the possibilities. Business men profess to believe that an animal equipment as operated is to be accepted as the most practical and economic in the conditions in which delivery is made. Taking the majority of delivery services, it is certain enough that system will yield a considerable saving and probably somewhat increase efficiency, which conclusion is obvious enough if analysis be made of the subject under consideration.

To illustrate: A concern having a transportation department rarely has accounting that will show expense detail even in a general way, and in many instances this cost may be covered by two or three general accounts. It is not possible to economize unless every item of cost is known and charged, and credit is made for the work performed at definite and accurate prices. It is exceedingly probable that as nearly, if not quite, all business concerns regard their deliveries as a necessary expense, and seldom if ever in any way productive, there is held to be no reason why the cost should be increased by additional clerical work. That is, the accounting of the expense of delivery would not effect an economy.

This, however, is an error that has cost enormous sums in the aggregate. With a definite knowledge of the expense of any work it is practical to adapt methods that may economize. Unless endeavor shall be made to minimize cost and a standard is known by which to measure a result, it is impossible to reach any satisfactory conclusion. Large corporations engaged in transportaton work have kept reasonably accurate account of expense with reference to locality and general work, and concerns of these proportions can make comparisons sufficiently certain to justify conclusions as to economy.

With rare exceptions, however, the business that is confined to a restricted area has no data that can be accepted as applicable to similar businesses in other places. Generally transportation expense is based on animal service that costs a given amount annually and there is no record of the work actually performed. Instead of cost a unit, whatever the form may be, and with reference to the character of delivery, a stated sum may, and often does, represent all charged expense for haulage.

There is no business that requires a greater ratio of delivery with relation to sales than the coal trade. The proportion of customers who haul their own supplies from the yards is very small. The haulage service of every firm is variable and the orders vary greatly. The small dealers, however, who sell in small quantities, are not to be considered in this article. The

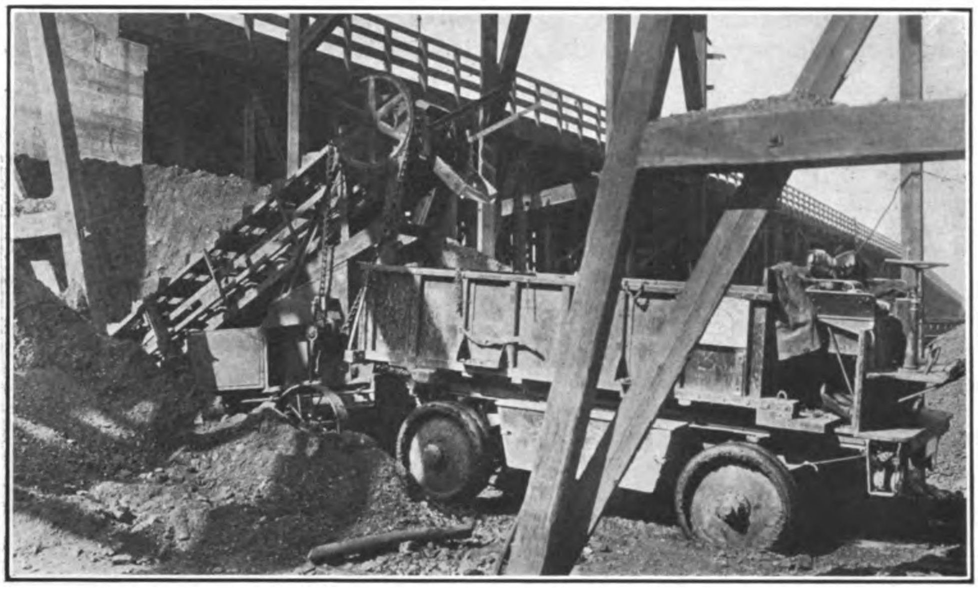
Couple-Gear Truck Under the Anthracite Coal Pocket of the John E. Cousens Coal Company, Ready for Gravity Loading.

family orders are occasional and the sales to shops, mills, hotels, apartment houses, office buildings, public service plants and the like require frequent and sometimes daily deliveries. The distribution to families means that the service requirements may fluctuate materially. The contract deliveries are more certain and the work can be better systematized.

In the large cities the cost of delivery is increased through the traffic conditions and regulations, by the character of the streets, by the manner of discharging the loads, etc., and this is offset in less populous communities by the greater distances, the less improved highways and the topography. The loss of time by motor vehicles in short hauls and congested traffic has

created the impression that horses are more economical because of the lesser cost and the delays that cannot be avoided. Experiments with motor trucks have generally been made by working the machines under the same conditions and with the same facilities as have been used for horses, and with so few a number that the cost was necessarily larger than would have been realized with a completely motorized delivery.

The John E. Cousens Coal Company, 781 Commonwealth avenue, Brookline, Mass., has a business that is peculiar in that it is partly in Boston and partly in the town of Brookline. Some of the deliveries are made as far into the city as the vicinity of the Boston common, and some are made in all sections of the town. The distribution covers a large area, and while a part is made under conditions that may be said to obtain in cities of large size the remainder is made in highways that are comparatively free from traffic, but are on hills having grades running as high as 10 per cent. Considering the widely differing conditions it may be said that the average cost of delivery is somewhat larger than would be experienced in a town, and will probably closely approximate that of the firm doing business in a city of large size.


Loading Coal with an Electric Loader at the Yard of the John E. Cousens Coal Company—A Decided Saving in Time.

This company receives its coal by barge at its dock in the Charles river and the orders are distributed from its plant at what is known as Cottage Farm. The cargoes are piled beneath conveyors or stored in pockets and handled in the usual manner. Practically all the anthracite coal is loaded from the pockets into the carts by gravity and loading machines are used to fill the carts from the piles of bituminous coal. The stable equipment of the company has averaged 56 horses and wagons and carts with capacity up to five tons.

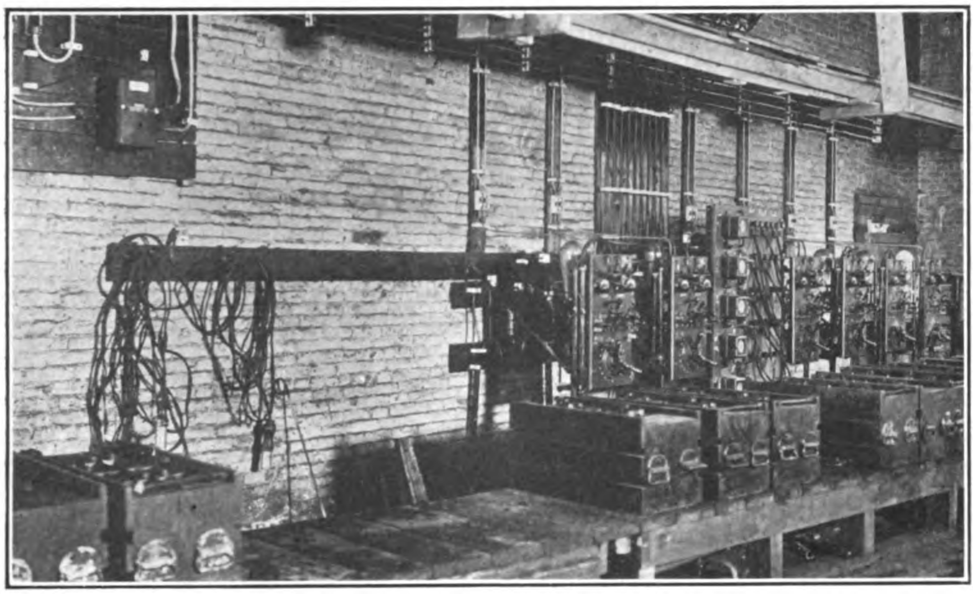
The horses were used exclusively until July, 1910, when the first motor truck, a five-ton Couple-Gear battery driven machine, was delivered. The company had had for a considerable length of time an accurate knowledge of the cost of horse distribution and when the truck was ordered a record was devised that would, it was expected, give dependable data of the truck expense. The intention was to work the truck as constantly as was practical, and a second battery was purchased so that a change could be made at noon and without loss of time. The original body was not fitted with a hoist, but later on one of the manual type was installed. The lack of quick discharging facilities was a handicap in the first use of the truck and this was realized the more with the fitting of the hoist.

The intention was, if the machine was found economical, to purchase others, and in a sense the work was experimental. The charging equipment was temporary in character and the truck was garaged at the yard until results could be satisfactorily determined. The use of trailers was thoroughly experimented, several carts of three and five tons capacity were utilized, being fitted with rods extending from the rear ends of the chassis frame side members to the equalizer of the wagons. With short poles to steer them the carts were found to handle admirably and the truck could haul its load of five tons and a trailer with a similar freight without appreciable loss of time as compared with trips without the trailer.

The truck was used for the long hauls and when not required for this class of work was sent out with family orders. The average daily mileage was 35 and the tonnage was from 20 to 25 tons with long trips and from 30 to 40 tons with short hauls. The trailers were fitted with dumping bodies and when large loads were to be delivered there was but little loss of time. In some instances a trailer was loaded for one delivery and this was hauled to the customer and uncoupled for unloading, the truck continuing on to another and picking up the trailer on the return trip. Where orders could be sent out in this manner the truck was extremely economical.

The record of work and expense kept by the company was such as to make possible a very satisfactory comparison of both the truck and animal vehicles and a second truck was ordered that was delivered in June, 1911. At that time the necessity of a garage was evident, and the company leased an abandoned roundhouse of the Boston & Albany railroad, on property separated from the yard by the Cottage Farm bridge approach, with the intention of using a part of it for storing the machines and the remainder for storage.

The roundhouse is considerably below the level of Commonwealth avenue and a horseshoe curve of steep grade affords access to it. One section of this was made a garage and in this was installed a pair of charg-



Charging Panels and Mercury Arc Rectifiers in the Garage of the John E. Cousens Coal Company.

ing panels and a motor generator loaned by the Boston Edison company pending a permanent installation. The second truck was equipped with two batteries. As the battery cradles of the trucks were underslung and side loading two platforms were built the height of the bottom of the cradles and the width of the battery trays, so that a truck could be driven between them and the exhausted battery removed at one side. Moving the machine ahead five or six feet the charged trays were placed in the cradle. The process was repeated on the other side. This eliminated lifting and facilitated handling and prevented a possibility of damage in changing.

The company employed an experienced battery man and mechanic and placed him in charge of the garage with instructions to keep the trucks up to the highest standard of efficiency and to devise such methods as might be productive of economy. The work of delivery was continued with trailers when this was possible and it was found that while these were economical with large loads to be delivered to one customer it was necessary to send a sufficient crew with them to handle the freight without loss of time for the truck, and where a trailer was taken out and left where it was necessary for the machine to lose time in returning for it the saving was materially lessened. If the trucks were not sent for the trailers and horses were sent out to haul them back to the yard there was the time of the men and the animals to be considered.

In the use of trailers the experience was that they could be used to good advantage where a load was to be delivered to one customer, or to two close together, especially if the loads could be discharged quickly and the trucks kept in operation, but in a business where the orders vary constantly it is not practical to use trailers where the loads are delivered a considerable distance apart and the truck must haul the trailer back. The company tried out the use of trailers consistently and for a sufficient length of time to insure a definite knowledge of economic work, and the decision was that trailers could not be profitably used unless the deliveries were to single customers or so close together there would be very little, if any, lost time for the machine. While hauling trailers did not materially decrease the speed of the trucks and very nearly the same time could be made as when the machines were used alone, there was naturally an increased wear on tires, and this was another item of expense that could not be overlooked.

When not hauling trailers the trucks were very economical of tires from the fact that traction is by all four wheels and there is an equalization of the strains of tractive effort, and in starting the power is exerted very gradually. Although the streets of Brookline are very hilly and the loads carried were large, the tires gave excellent satisfaction.

The third truck was ordered and was delivered in August, 1912, this being of the same type as the others and fitted with a dumping body. The machine

Battery Platforms in the Garage of the John E. Cousens Coal Company, with Two Men Beside the Machine Changing a Battery.

REPORT OF TRIPS AND TONNAGE

Truck No.	Monday Trips	Monday Tonnage	Tuesday Trips	Tuesday Tonnage	Wednesday Trips	Wednesday Tonnage	Thursday Trips	Thursday Tonnage	Friday Trips	Friday Tonnage	Saturday Trips	Saturday Tonnage
1												
2												
3												
4												
5												
6												

Remarks:

Form 1—This Being a Record of the Number of Trips and Tonnage of Each Truck for Each Day of the Week.

was placed in the same service as the others and it was utilized so far as possible for the longer hauls and, whenever necessary, for delivering family orders. The third charging panel was installed in the garage and the motor generator was sufficient to meet the requirements for energizing the batteries. The platforms for the batteries were increased in length and a system of charging was established so that in the morning when the trucks went out they each had a battery that had been charged in the machine during the night. At noon these were removed and the other batteries, which had been charged the afternoon previous, or during the morning, installed. When the trucks were brought in at night the batteries in them were charged without removal, and these were again used the next morning. This necessitated two charges and discharges of a battery one day, and one charge and discharge the next.

The time required for a change of battery varies from 12 to 15 minutes, and it may be said that 14 minutes will be an average. Time is taken from the entrance of a truck into the garage until it leaves the door going out, and as this work is done at noon when the drivers have an hour, it will be understood that rarely, if ever, is there any delay or loss of efficiency. The fourth and fifth trucks were ordered and were delivered in October and November, and with these in use the charging installation was changed. The motor generator was removed and three panels additional were installed, each fitted with a 5-50 mercury arc rectifier, and the current taken from the alternating current of the main line feed that was brought into the garage. Two of these are arranged to be coupled so that a current of 100 amperes may be used if it is necessary, and with two spare batteries this afforded a sufficient reserve for all emergencies that might arise. In the use of these trucks the battery platforms were extended to take six batteries at either side, and this afforded all the space necessary in handling them.

The sixth truck was delivered to the company directly after the close of the Boston motor truck show, and this is now in service. It differs from the others in that it is driven by the front wheels only and it is expected to have a daily mileage of 25 with a single battery charge or perhaps twice that with a change of battery. The machine is a type that has been used by a number of coal firms in Boston and it carries the load on the rear wheels, which are shod with steel tires. The purpose is to test this machine in the same service with the others and to learn wherein it differs so far as the economy of work is concerned. With this machine the full charging capacity of the garage is utilized according to the system of charging inaugurated, but it is by no means up to the maximum service that can be obtained by using the panels constantly. Of course, with the increased use of the rectifiers their life is necessarily shortened in number of days, but each can be expected to afford an approximate service.

In adapting the roundhouse to the needs of the company as a garage but one division was necessary, and that will house more than the present number of machines in use. Aside from the charging panels and the battery platform a work bench with an equipment of hand tools is practically all that is needed, and the only spare that is kept on hand is an extra wheel, which contains a motor. In the event of a motor defect developing in a wheel it is removed and replaced by the spare, an operation that can be accomplished in three hours or less, and the defect is remedied and the restored wheel replaced.

The machines require attention in oiling and greasing, and adjustments are made where wear is evidenced. Naturally all bolts are kept tight and the

COUPLE-GEAR TRUCKS

Garage Report for Week Ending

Truck No.	B 1	B 2 Ampere Hours	Total	Odometer Reading	Time Taken Changing Batteries	Lost Time	Remarks	Truck No.	B 1	B 2 Ampere Hours	Total	Odometer Reading	Time Taken Changing Batteries	Lost Time	Remarks
Truck No.	B 1	B 2 Ampere Hours	Total	Odometer Reading	Time Taken Changing Batteries	Lost Time	Remarks	Truck No.	B 1	B 2 Ampere Hours	Total	Odometer Reading	Time Taken Changing Batteries	Lost Time	Remarks
Truck No.	B 1	B 2 Ampere Hours	Total	Odometer Reading	Time Taken Changing Batteries	Lost Time	Remarks	Truck No.	B 1	B 2 Ampere Hours	Total	Odometer Reading	Time Taken Changing Batteries	Lost Time	Remarks

Form 3—A Garage Report Showing the Mileage, the Current Supplied Each Battery and Other Details of Operation.

WEEKLY COMPARISON OF PERFORMANCE

Week Ending	Trucks 1	2	3	4	5	6
Trips						
Miles						
Tonnage						
Ton Miles						
Ampere Hours						
Lost Time						

Form 2—A Comparative Record of the Work Accomplished with Each Truck for Each Week.

trucks are gone over regularly to insure that no condition of deterioration has developed. They are under the constant observation of the manager of the garage and each driver reports to him when the trucks are brought into the garage if there is any condition of operation that seemingly requires attention. Each vehicle is expected to be ready for service the morning of every working day and lost time is carefully guarded against.

The record kept of the trucks is shown on several forms that are filed in the office and are exceedingly simple. What may be termed Form 1 covers a period of a week and under each day is noted the number of trips made and the tonnage carried by each truck, and below this is entered any fact that may be necessary to explain a discrepancy or variance from the work that may be ordinarily accomplished.

Form 2 is known as a "Weekly Comparison of Performance" and indicates for the noted period the number of trips, miles driven, tonnage, ton-miles driven, ampere-hours of electric energy used and the lost time for each truck. Some of the facts shown by this sheet are taken from Form 1.

Form 3 is kept in the garage and at the end of the week is sent to the office. Against each truck is a daily statement which shows the number of ampere-hours of electric current supplied to each battery and the total for the two, the odometer reading taken at night, the time required for changing batteries, the lost time and a note of any circumstance that may need explanation. Six of these statements appear on a single sheet and these supply the remainder of the facts for Form 2.

A record is kept of the current supplied to the batteries as shown by the readings of the sangamo meters, giving the number of the truck and the ampere-hours supplied by day and by night. This covers a period of a week and is filled by the manager of the garage. The record states: "This is a record of the total amount of electric current supplied the batteries, as indicated by the readings on the sangamo meters on the switch board for the week ending ———." "Note—It is understood that all current, whether in the batteries on the benches, or supplied to the batteries in the trucks, goes through and is measured by the meter on the switch board." From this record is filled the other data required by the three forms stated above. In the garage is posted a record of "Work and New Parts," on which is entered the different parts renewed and the date and number, and the number of the truck, it being understood that there is labor involved in making such replacement or restoration. This record is shown as Form 4.

The company has worked five trucks, one of them since July, 1910, and each machine is rated as the equal of at least three two-horse teams and carts, and while this equipment has been added gradually the number of horses in service has not been decreased. With the advent of the sixth machine there is no apparent reason to eliminate any of the animals, and it will be understood that the company has sufficiently increased its business to require the six machines, which can be considered as equal to 40 horses, since the trucks have been used. This conclusion is obvious, for the company has retained all its horses and has added to its motor equipment. The machines have made possible the development of business that was not previously within the area where it could be profitably developed.

The company regards the cost figures of its motor delivery service as an asset of its business and is not

REPAIR WORK

Trucks 1	2	3	4	5	6	Parts	Date and Number
						Controller	
						New Fingers	
						New Contacts	
						Other Parts	
						Steering Gear	
						New Sector	
						New Worm	
						New Joints	
						Brakes	
						New Band Linings	
						New Collar	
						Other Parts	
						Chassis	
						Springs	
						Motor	
						Motor	
						Gears	
						Screws	
						Wheels	
						New Brushes	
						Commutator Sanded	
						New Thrust Collar	
						New Wicks	
						New Pinions	
						New Roller Bearing	
						New Evener Parts	
						New Short Shaft	
						New Disc or Repaired Wheel Put On	

Form 4—A Record of the Repair Work Performed on Each Truck and the Replacements—Kept at the Garage.

willing to state these, but the statement is made that its experience has been that the figures follow very closely the estimate of the manufacturers of the machines. The estimate is as follows: Driver, \$2.50; current, \$1.60; tires, \$2.35; batteries, \$2.67; new parts and repairs, 50 cents; depreciation at 10 per cent., \$1.33; fire insurance, 40 cents; liability insurance, 32 cents; floor space at \$50 a year, 17 cents; supervision, 50 cents; interest at 5 per cent., 50 cents; a total daily cost of \$12.84 a machine. With an average mileage of 40 and carrying five-ton loads this gives 100 ton-miles daily, at a cost of 12.84 cents a mile.

All of the garage work is done by one man with such assistance as he may from time to time require, and he also gives attention to two automobiles used by the members of the company. The attention to the batteries is practically confined to equalizing them with distilled water to restore what is dissipated through evaporation, and there is a contract with the agent for the truck that when the efficiency of the batteries fall below 90 per cent. the plates are renewed.

DEMONSTRATING KELLY LINE.

California Agent Adopts Novel Method of Showing Two Models at the Same Time.

A novel method of showing the different models of Kelly trucks, made by the Kelly-Springfield Motor Truck Company, Springfield, O., has been originated by Frank G. Miner, manager of central and southern California for this line. The two principal models at present are the one and three-ton vehicles.

When Mr. Miner starts out to make a demonstration to a prospect, he places the one-ton truck on the body of the three-ton machine and is thus able to show both vehicles at the same time. This method has attracted considerable attention at San Francisco, which is Mr. Miner's headquarters.

REPLACES TEN TEAMS.

Knox-Martin Tractor Proves Successful in Handling Work of San Francisco Concern.

A Knox-Martin tractor, made by the Knox Automobile Company, Springfield, Mass., recently delivered to a big trucking company at San Francisco, Cal., has been carrying 9.5 tons on each haul, displacing 10 teams formerly required for the work with such satisfactory results that the firm has decided to install Knox tractors in place of all their horses as fast as possible.

The tractor has solved the problem of drayage in San Francisco because it is so well adapted to this class of work and has not necessitated any change in the present method of handling freight and merchandise. The same trucks that were formerly used in the work with horses are now being operated by the tractors with remarkable results in both tonnage capacity and economy.

FINDS TRUCK EFFICIENT.

Interesting Figures Compiled by Chicago House After Year's Use of KisselKar Vehicle.

Henry Frerk Sons of Chicago, dealer in building materials, coal and feed, has operated a four-ton KisselKar truck, made by the Kissel Motor Car Company, Hartford, Wis., during the past year. The vehicle has replaced two double and one single horse teams and the figures compiled are interesting.

The truck was in service 263 days and covered 10,241 miles, an average of 39 miles a day. The average weight carried a load was 7225 pounds. One gallon of gasoline was used for each 28 miles and the tire expense a mile was five cents. The firm finds the machine is of particular value in taking care of distant deliveries quickly, thus materially widening its field of service.

MOTOR TRUCKS AND GOOD ROADS.

President Willys Foresees Decided Benefit as Result of Governmental Assistance.

Though few people are aware of the fact, that the national government gave the motor truck industry substantial assistance last September, when Congress passed the postoffice appropriation bill, is the opinion of John N. Willys, president of the Gramm Motor Truck Company, Lima, O., maker of Gramm trucks. Attached to this bill was a rider, which aroused very little comment, mainly because its importance was not understood, providing for the building of good roads throughout the country, the work to be carried on in conjunction with the efforts of local authorities in the various states. Mr. Willys says:

"Not only does the primary idea of the bill, the improvement of roads throughout the country through federal aid, mean a vastly increased field of operation for power vehicles, but the actual work when it is undertaken will open a greater opportunity for the use of motor trucks in road buildng service. The plan outlined in the government measure is an excellent one. It calls for an appropriation of \$500,000 to be spent in improving roads selected by the government, over which rural delivery is or may hereafter be established. Each state in the Union is to be allotted about \$8000 for the improvement of two post roads each year, with a reserve fund of \$2000 to be spent annually in the maintenance of such roads.

"All over the country the practicability of motor trucks in road building has been proved. One eastern firm has been using a Gramm truck in this work for several months and reports that the vehicle is accomplishing the same results as five two-horse teams formerly produced. The Gramm not only carries much more material than a horse drawn wagon, but consumes less time in transportation and further demonstrates its economy by eliminating a large percentage of the necessary labor."

FEDERAL AIDS SHIPPING.

Replaces Four Horses at Substantial Saving, Although Service Is Very Intermittent.

The Leyland Steamship Line, with headquarters at New Orleans, La., recently purchased a Federal truck, made by the Federal Motor Truck Company, Detroit, which displaced four horses. This company owns a number of wharves in New Orleans and must transport unloading skids and cranes from one quay to another to meet every inbound steamer. Heretofore, it was necessary to keep two two-horse teams in service, one working days and the other nights, in order that they might be ready at a moment's notice to remove tools and equipment from one ship to another.

This system was found to be expensive and the officials of the company decided that a substantial saving could be made by replacing the horses with a motor truck. The teams, although travelling but a short distance, were compelled to stand in the sun, rain and cold, awaiting orders. The elements have no effect on the Federal truck, and it is always in readiness to respond to a call from any dock. The gasoline consumption is small and the truck does the work much faster and covers more ground than formerly was true with horses.

BUFFALO'S FIRST TRUCK SHOW.

More Than a Score of Makes Shown at Exhibition Productive of Numerous Sales.

The show of service vehicles held at the Auditorium, Buffalo, N. Y., from March 12 to 15 inclusive, was the first exhibition of the kind ever made in that city, for in previous years they had been exhibited with pleasure cars. The Buffalo Automobile Dealers' Association decided to have the show for four days only and the show committee realized that a week would not have been too long a period, for the interest manifested was surprising and the promotive results were in every way satisfactory.

In all more than a score of different makes of machines were shown, there being close to 100 vehicles in the exhibition. In addition there was a very large motorcycle section and a considerable number of exhibitors displayed accessories and supplies.

WOULD HEAVILY TAX MOTOR TRUCKS.

Decided Opposition Develops Against Passage of Bills Now Before New York Legislature.

A determined effort has been made by the Motor Truck Club of New York City, and differing interests, either from the viewpoint of the industry and trade or from that of the owners and users, to oppose the legislation now pending before the New York legislature. The bills proposed are objected to on many grounds, one of which is that motor vehicles used for business purposes should not be subjected to additional tax, and another is that the control of drivers is not reasonable or logical. It is maintained that the application of the law rests with the courts, and individual interpretations of a bill are no criterion by which to judge its results; that to tax machines for the use of the highways is vicious class legislation, and that the requirements as to drivers are such as will cause inconvenience and in many instances hardship for business men.

The belief is that it will require careful and persistent endeavor to frame a bill that will differentiate the classes using motor vehicles and properly protect the interests of all the people. The proposed law is regarded as impractical and of such a character as would seriously affect all owners of service machines and discourage the business development that might be possible with their logical and rational use.

PORTABLE WIRELESS STATION.

New Type of Motor Vehicle Being Demonstrated to Government Officials.

A new portable type of complete wireless telegraph station has been exhibited recently to the government officials at Washington, D. C. The outfit, which includes two telescopic towers, is carried on a large automobile truck, and the two towers can be raised to an altitude of 200 feet by the same motor which propels the vehicle.

The instruments and generating apparatus are located in one of the rooms into which the body of the truck is divided. This room is also used by the operator in the sending and receiving of messages. The equipment includes a searchlight which, if necessary, can be hoisted and operated from the top of either of the 200-foot towers. At night illumination is supplied by a small electric plant operated by the truck motor.

The John Bell Company, a builders' supply firm in New York City, has placed an order for five Garford motor trucks of six tons capacity each, made by the Garford Company, Elyria, O. This firm bought a Garford machine about a year ago and the development of the Bronx borough, with its large building operations, has resulted in greatly increased business for the Bell company, which necessitated this enlarged equipment.

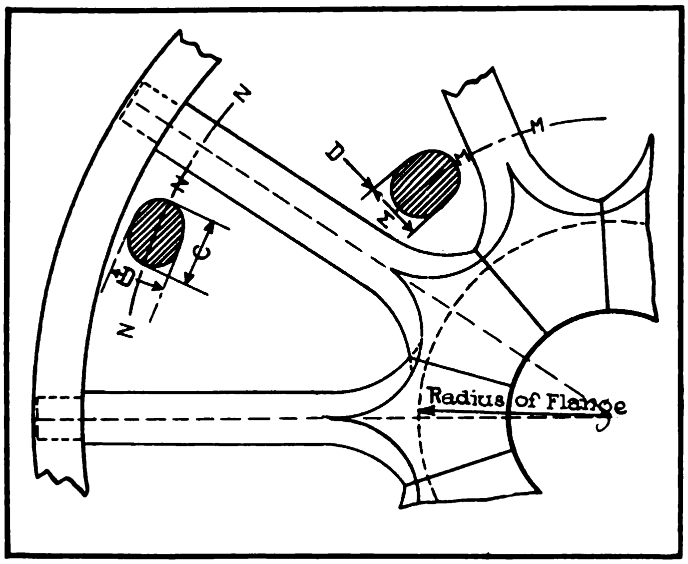
A handsome motor hearse built by the Peerless Motor Car Company, Cleveland, O., and displayed at the Chicago truck show has been purchased by the Newberry Auto Livery Company, Chicago, for use in conjunction with its 21 Peerless touring cars for funerals.

MOTOR TRUCK WHEEL CONSTRUCTION.

With No Standards for Dimensions or Stock, Designs Are Based Usually on Individual Experience or General Knowledge—Some Methods of Estimating Strength and Results From Laboratory Tests.

FOR several years the attention of manufacturers of automobile vehicles, both in this country and abroad, has been directed toward the service to be obtained from different types of wheels. The subject is not new, but the changed requirements have impelled careful study and investigation with a view of determining what would be the most enduring in the works for which vehicles may be used. For a very long period, in fact for centuries, wood was the material utilized, because of the cheapness and ease of working, and from the fact that with animal vehicles it was not subjected to great stresses.

With the construction of wagons and carriages dimensions were made without engineering knowledge, but generally were what in the judgment of the builder would serve the purpose. The staggered spoke type was adopted because of its assumed greater



Comparative Proportions of a Well Designed Automobile Wheel.

strength. Wheels were dished to resist the strain of turning and to bring the line of support more nearly vertical when the vehicle was standing or moving on an inclined surface.

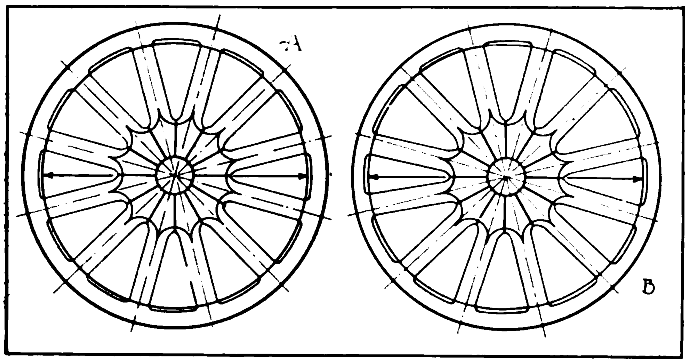
There are today no recognized standards for the construction of wheels save the felloe and rim dimensions adopted by the Society of Automobile Engineers, and the standard grading rules for vehicle wheel hickory wood stock, which were agreed to at a conference held Dec. 28-30, 1908, by the authorized representatives of the United States forest service, the wheel manufacturers, spoke manufacturers, rim manufacturers and the National Hickory Association. These grading rules were based upon the strength of hickory stock as determined by the mechanical tests of the forest service of the United States government, made at the Perdue University timber testing station at Lafayette, Ind., through the co-operation of the National Hickory Association. These tests determined that red, or red and white mixed hickory of equal dry weight and having similar defects was of the same strength as white hickory, and should be graded according to its quality regardless of its color.

These grades are known as A, B, C, D and E, and after a series of suggestions, definitions were adopted and rules agreed upon for the selection of stock for spokes and rims. So far as is known these rules are observed by all dealers in wheel stock and by those manufacturing wheels, but there are no rules for grading stock for automobile wheels. It may be accepted as a fact that the strength of hickory can be based upon weight, all other conditions being equal. But with the greatest care in the grading of hickory it is practically impossible to absolutely determine strength. This was demonstrated in the tests made at Perdue University to secure data for the conference to which reference has been made, where it was found in a long column or compression test of 45 grade C white spokes, one inch size, that the maximum load sustained before failure was 4220 pounds and the minimum load 1720 pounds, a difference of 2500. It is not purposed to discuss quality of wood entering into wheel construction, but it will be assumed that stock is as nearly uniform as it can be selected with careful observance of the standards for grading.

It should be stated, however, that it is hardly possible to make exact comparisons between wheels of European and American manufacture, because there are no known standards abroad, and it is impossible to find there wood that will compare in quality with the hickory of this country. In England especially the wood that would be suited for wheels is not obtainable from native stock, and for that reason it may be said that wire and metal wheels are regarded with more favor than they are elsewhere and are more generally used. In continental Europe woods that are much more suited to wheel construction, and which have much greater enduring qualities, are obtainable, this being especially true of France and Germany.

The building of wheels for animal drawn vehicles was generally by a "rule 'o thumb" and while every manufacturer probably will make recommendation as to dimensions that would give a reasonable or perhaps an entire satisfaction in service, it is extremely improbable that there would be agreement as to dimensions. There are, however, makers who have very carefully determined stresses and strains that must be endured by wheels and in constructions that are produced to meet with specified requirements the strength is sufficient and the stock is as uniform as it

is possible to select it. Some of the makers of the best wheels, which are built for the manufacturers of high class automobile vehicles, make the statement



Well Built Wheels: A, Felloe Joints Correct and Spokes Lined; B, Faulty Construction, with Joints and Spokes Not Correctly in Line, Weakening the Strength Materially.

that they seldom if ever determine the specifications of their products. The detail of the work is prepared by the builders of the machines and the wheels are turned out to the proportions wanted. These specifications vary materially. For instance, one of the makers of a three-ton truck specifies that the front wheels shall be 36 inches diameter with a 2.25-inch spoke, and the rear wheels with a 3.5-inch spoke, the front wheel to be equipped with a single and the rear with a dual tire. For the same size vehicle orders have been received for a two-inch spoke for the front wheel with a four-inch tire, and rear wheel a 2.75-inch spoke with a four-inch dual tire.

These instances are cited to illustrate the variance of the requirements of the builders of motor wagons, and to make clear that it is not possible to regard the wheel equipment as being uniform or standard. It is not for the wheel makers to question the specifications sent to them. These are prepared very generally by the engineers of the automobile manufacturers, and occasionally by the engineers employed by the axle builders, but these are not based on standards as are estimates for metal construction. It is stated by men who may be regarded as authorities that the sizes and dimensions for carrying different weights appear to be the deductions or opinions of architects and engineering draftsmen, and that it would seem practically impossible to determine these dimensions accurately.

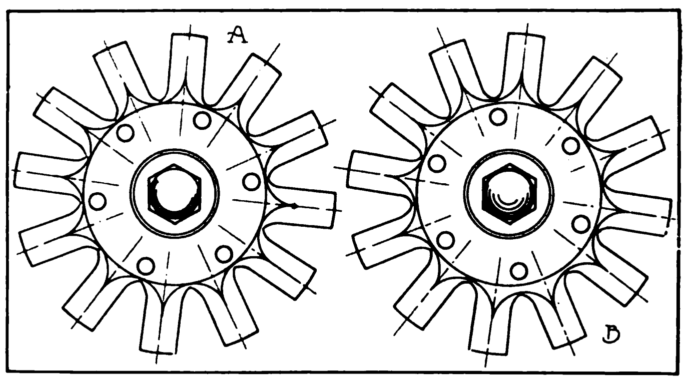
One manufacturer, in writing of the subject, makes the statement: "You will find that cars of from 1000 to 1500 pounds will use a 1.24 to 1.375-inch spoke, with a corresponding height of wheel and width of tire. A car weighing from 1500 to 2000 pounds will use a 1.5-inch, 1.675 to 1.75-inch spoke. Very few cars of this weight will use a spoke larger than 1.75 inches.

"We have had occasion to quote upon a great many different styles of truck wheels, and there is such a variation in them owing to the varying opinions of the manufacturers, that it would be absolutely impossible to give you standard dimensions per weight or per load carried."

It must not be assumed, however, that the wheel manufacturers are unmindful of wheel requirements. It is extremely probable that were they regarded as the authorities, with their experience and engineering data they would produce what would eventually be standards. As conditions now are they are compelled to accept any design submitted to them by the hundreds of engineers or engineering departments of automobile manufacturers. The wheels are guaranteed to endure under the service for which the vehicle is designed by the customers, which does not mean abnormal use or abuse by extreme overloads, and with firms that give these guarantees the wheels are fully checked as to strength under compression, dishing and torsion.

There is absolutely no standard for dimensions of spokes and felloes for the different diameter wheels for pleasure vehicles, and the dimensions of the spokes for service wagons are not standardized, but the felloes for such machines are standardized by the Society of Automobile Engineers. The dimensions for spokes are usually determined by the cross sectional area of the spoke and the weight of the vehicle on which the wheel is to be used. The dishing strength is figured from the hub flange diameter and the speed at which the vehicle is driven. There are principles recognized for pleasure vehicle wheel building that may be regarded as standard requirements, and in this respect there has been more attention given to such wheels than to those for service wagons. For instance, the angle of inclination allowed wheels when dishing is from 1.5 to two degrees from the full length of the spoke.

The weight of wood wheels for pleasure vehicles depends entirely upon the rim equipment, that is, the wood parts will remain practically the same, while the band is either heavier or lighter, according to the type applied. The sizes of wheels usually recommended for service wagons are often if not generally recommended by the tire companies, for these concerns are compelled to guarantee their tires for a specific mileage or service. For this reason the determination of sizes and proportions of wheels is frequently not left to the



Spoke Arches Correct and Incorrect: A, Equally Spaced from Outside Edge of Hub Flange; B, Unequally Spaced, a Guess Job and Poorly Done.

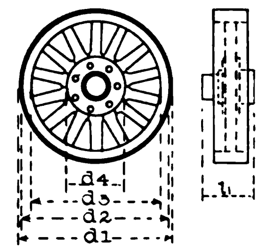
wheel makers, but the needs are established by those who cannot have the experience and the actual knowledge of working requirements.

In establishing load capacities it may be taken as a general rule that the rear wheels endure about 50 per cent. more weight or work than a front wheel. While this is, of course, a very broad statement, and should only be accepted as such, it will serve to illustrate the difference in the requirements and the strength ordinarily demanded. In some cases, according to the design of the vehicle, the rear wheels are made to carry a much greater percentage of the load than has been stated. The stresses upon a rear wheel in addition to those upon a front wheel are purely of those torsional strains given by the driving sprocket and the brake surface, to which must be added the side thrust when making turns and when the wheel is moving on a surface that is inclined. The front wheels, of course, have the same side strains and compression strains, and the driver lacks control or the machine becomes unmanageable for an instant it begins to skid. Assume that the inclination to the centre line of the road or the original direction of movement of the machine is 45 degrees and that the skid is in that direction. On most country roads the vehicle would not skid a much greater distance than four feet without striking soft earth or some other obstruction at the side of the roadway. Taking the weight of the machine, the speed, the angle, the coefficient of friction of rubber upon earth, and assuming that the car must be stopped within four feet will be the factors from which can be determined the side strain that must be withstood by the front and rear wheels. From this result may be figured the flange diameter that will give the cross sectional area in the miter surface to withstand the strain.

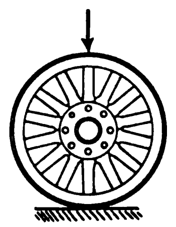
Number	Kind of Wheel	Weight lbs.	Diameter d1	Felloe			Spokes		Hub			Kind of Loading	Max Load Applied	Number
				diam, d2	diam, d3	thickness	number	kind & dimensions	length L	diam, d4	number of bolts			
1	Pleasure	38	27.3	25.63	23.3	1.33	12	a 1.1×1.4	6"	7.3	6	Dishing	10000 LB.	1
2	"	38½	27.3	25.8	23.3	1.52	12	a 1.1×1.4+	6"	7.3	6	Direct	18900 "	2
3	"	29½	26.3	24.7	22.33	1.32	12	a 1"×1.2	5.2	6.6	6	Dishing	3300 "	3
4	"	30¾	26.3	24.7	22.3	1.32	12	a 1"×1.2	5.3	6.6	6	Direct	13700. "	4
5	"	41½	29.3	27.7	25.4	2.0	12	a 1.3×1.8	6"	7.3	8	Dishing	9100. "	5
6	"	41¼	29.3	27.7	25.4	2.0	12	a 1.3×1.8	6"	7.3	8	Direct	22300. "	6
7	Truck	60½	28.3	27.8	24.3	2.3	12	b 1.6×2"	7.1	8.8	8	Dishing	16100. "	7
8	"	60¾	28.3	27.8	24.3	2.3	12	a 1.3×1.9	7.1	8.6	6	Direct	40800. "	8
9	"	186½	30.3	29.75	25.4	8.0	14	a 2.3×2.9	9"	12.0	7	Dishing Direct	30100. " 107000 "	9
10	"	286.	34.6	33.83	29.83	10.0	14	a 2.9×3.3	12"	13.7	8	Direct	140000. "	10
11	"	188	30.3	29.75	25.4	8.0	14	c 2.1×3.0	9"	12.0	7	Direct	114000. "	11
12	"	290	34.3	33.8	29.8	10.0	14	b 2.2×3.3	12"	13.7	8	Dishing Direct	48300 " 133000. "	12

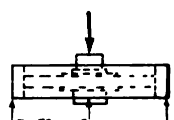
Wheels Nos. 9 and 12 were tested first under dishing load up to loading recorded, then tested under direct loading

Kinds of Spokes.



Sketch, showing dimensions


Direct Loading


Wheel 1 supported at 3 points
Wheels 3,5,7,9 and 12 sup'd at 4 points.
Dishing Load

Summary of Tests of 12 Wheels for the Hayes Wheel Co., Jackson, Mich.

Testing Laboratory, Univ Mich

1911-July 19 C J [illegible] Engineer

same torsional strains that are due to revolution.

The overload that a well constructed wheel will endure is limited to the bearing area of the spoke upon the felloe. Taking the material from which the wheel is constructed, figuring the cross section area of the spoke and the strains a square inch, the amount of load that can be carried without failure can be fairly determined. To find strength or capacity of a wheel, the dish strength is determined from the speed at which the machine is to be driven and from the weight of the vehicle. In computing the dish for a pleasure vehicle wheel, for instance, the following illustration will serve:

It may be assumed that the machine is driven at a speed of 20 miles an hour on a country road that is comparatively smooth in the centre. Because the

The compression strains are figured as above stated, according to the cross sectional area or the bearing surface of the spoke upon the felloe. The construction for the best or greatest strength is a matter that may be stated in the following manner: The material of which the wheel is constructed must be absolutely dry, so that when it is assembled and the compression placed upon the miter circles by the band or rim, there will be no lessening of size. It might be well to state that there has been no standardization of the hub flanges used for pleasure cars or service wagons.

The emphasis that has been made of dry stock will be the better understood when it is realized that practically the entire strength of the wheel depends upon the tire or rim that encompasses it and binds it together. Wood as it is seasoned will lessen in every

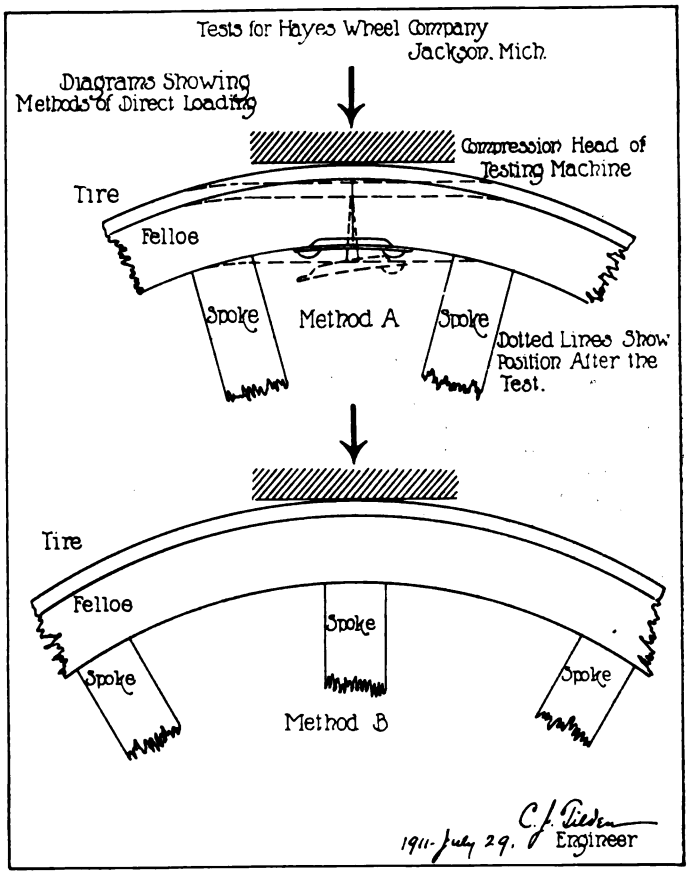
dimension, and it will shrink until all moisture has been dissipated. Seasoning or drying is best done in the open air and finished in kilns or ovens, where heated air is circulated about the lumber. Heating wood will reduce it to the smallest dimensions, and it will increase slightly when cooled and will expand to the maximum by saturation in water. Alternate wetting and drying will cause rapid deterioration of timber, but kept constantly dry or wet it will endure for an almost interminable length of time. Authorities on wood and wood working maintain that the American method of kiln drying lumber affords the best and most certain character of material, and that when built properly with reference to engineering principles there will be a minimum of changes from expansion and contraction.

Wood will contract and expand unequally, that is, different pieces will differ so far as absorption of moisture is concerned, and no matter what care is taken it is impossible to select stock that will be uniform in its changes. To secure material that will be as nearly equal as is practicable the grading rules have been adopted and weight accepted as a standard of strength. When the wheel is built the strength of the structure to resist twisting strains or side thrust depends upon the proportion of the spoke in the hub or between the hub flanges, and upon the area of the spoke cross section to carry the load. But the resistance to compression is proportional to the maintenance of the relation of the spoke and the felloe. Thus the tire or rim should bind the wheel so that it will always hold it securely, no matter what the climatic or atmospheric conditions, and the wood should be preserved so far as is possible against influences that will cause extremes of expansion or contraction.

When rear wheels are constructed they are designed for the attachment of brake drums, and these may be incorporated with the inside hub flange, or drums may be attached by clamps to the spokes or bolted to the spokes. All three of these designs are used generally, but it is probable that the last named type is the most common. By many engineers this construction is regarded as the best, provided that the bolts are centred in embosses in the spokes and the embosses' cross sectional area is equal to the cross sectional area of the remainder of the spoke. The strength of the spoke is retained in this type and the additional lever arm from the bolt head to the centre of the wheel is much greater than with other designs.

Saturation of the pores of the wood with oil will protect it, but to coat it with a thoroughly good paint, and to renew the paint as often as it is necessary, is believed to be the best protection that can be given. As only the exposed portions of the wood can be painted after the wheel has been constructed it would seem that there should be extreme care taken by the makers to paint and in every way protect the ends of the spokes in contact with the hub box and the hub flanges, the ends of the spokes in the felloe and against the rim and the felloe where it is covered with joint plates and the rims. Where these parts are not proof against expansion and contraction they may eventually decay and become weaker, to say nothing of the greater variation of dimensions from moisture and drying.

In applying the rim the wood, assumedly containing but a very small percentage of water, will shrink with the increase of temperature, and the rim, if heated, will expand, so that with the cooling of both materials a considerable degree of compression exists equally at all points. It will be noted, however, that there is a difficulty in painting the outer periphery of the felloe in that a heated rim will have a more or less destructive effect upon the pigment, and unless a rim is sufficiently expanded it will not be possible to install it or secure the proper compression. But when a rim



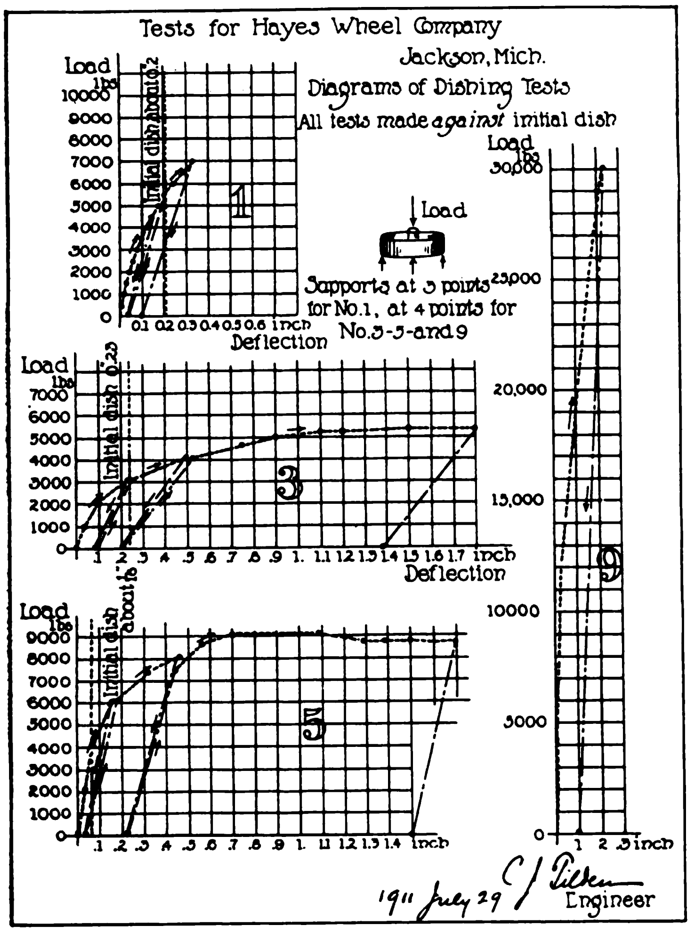
is once applied it is supposed to so bind the wheel that it will have its maximum strength when the wood has been shrunken, and will not cause distortion when the wood has been expanded by absorption. Extremes of heat will cause the wood to shrink and the metal to expand, and very low temperatures will correspondingly expand the wood and contract the rim. Heat is a factor of material importance, so far as the wood is concerned, because it causes shrinking, while moisture has the same effect with regard to expansion. The rim is not sufficiently changed by conditions ordinarily met with to justify consideration.

The shrinking and swelling of the wood from the hub to the face of the wheel as stated by a well known authority is summarized in this manner: If the wheel is of good, sound material, perfectly dried, swelling

caused by the climatic changes is not sufficient to deteriorate from the strength of the wheel. But this, of course, means that the wood shall be properly protected.

The small wheel is relatively stronger than the large against side thrust and torsional stresses because of the lessening of the lever arm, and that the members are relatively larger in proportion than those of the construction of increased diameter, but this strength is not a sufficient value to justify the rejection of the large wheel and its other manifestly good qualities.

While it is certain enough that the strength and endurance of wheels depends very largely upon the quality of the materials, there is no standard by which



a definite value may be established for varying sizes and constructions. The Hayes Wheel Company, Jackson, Mich., which has a very comprehensive engineering department, has supplemented the data obtained from the usual channels and from observation and experience, by a series of tests made at the testing laboratory of the University of Michigan. The charts included with the report of the tests made to the company are reproduced in connection with this article and the attention of the reader is directed to them.

Twelve wheels were tested, six for pleasure cars and six for service wagons, and these were subjected to dishing and compression tests to determine the elasticity of the different samples. It will be noted that there was some variance in the weights of wheels of the same type and sizes, and there was also slight difference in the diameters of the spokes and felloes. The greatest difference in the weight of pleasure car wheels of the same size was 1.25 pounds, and the variance in size of members or assembly was .05 inch. These wheels were supposedly pairs and one of each size was subjected to dishing and the other to compression stresses. The manner of applying the direct and the dishing loads are shown in the chart that gives the results, together with the points of measurement and the cross sections of spokes. It will be noted that two of the six truck wheels were tested for both dishing and compression.

The dishing tests were made by applying pressure to the hub of the wheel against the initial dish, the rim being supported at either three or four points, and the charts show the degree of deflection with varying loads, though not for all of the wheels. The chart denoting the results of the direct loading tests shows that two methods were used, these being designated as A and B. In test A the load was placed directly over the felloe joint and pressure was applied until bolts holding the joint plate failed and the rim was flattened, the felloe forced or broken down and the joint separated at the inner periphery. In this the pressure was applied between the spokes. In test B the pressure was applied directly above a spoke. It will be seen that this tested the weakest and the strongest parts of the wheels. It also will be seen that the smallest truck wheel was tested with a dishing pressure of 16,100 pounds and its mate was compressed with an external weight of 40,800 pounds. One of the next size was tested for dishing to 30,100 pounds and direct compression to 107,000 pounds, and its mate to 114,000 pounds direct compression. One of the largest wheels was tested to 48,300 dishing pressure and 133,000 direct compression, and its mate to 140,000 compression. The extreme figures for strength were 24 tons for dishing and 70 tons for compression.

These wheels were new and were tested at their best. It is probable that the strength would be somewhat reduced as they were used. It is also probable that were wood wheels in service in damp countries like England, or in the semi-tropics or tropics, there would be extremes of expansion and contraction that would eventually have deteriorating effects, so far as strength is concerned.

In the construction of wheels where the facilities are adequate a heating over is usually used to shrink the wood and heat the rim so that the assembly may be complete. As the wood is dry when the wheel is assembled, the best practise is to "prime" them with oil and lead so that they will not be susceptible to changes of temperature and atmosphere. Where wheels are cheaply made this provision may be omitted and the wood will swell and the grain raise, and perhaps other and more serious results follow. When wheels are so protected and are shipped by freight, for instance, they should be permitted to dry gradually and thoroughly before painting.

Municipal Service Equipment

COMPARATIVE COSTS IN SPOKANE.

Chief of Fire Department Presents Figures That Show Decided Economy.

Figures compiled by Chief A. L. Weeks of the Spokane fire department, Spokane, Wash., as to the comparative cost of automobile and horse drawn apparatus are taken by him to mean the gradual elimination of the horse as part of the equipment of the department. The city purchased two pieces of automobile apparatus in 1912 and will install two more during 1913, one of which will be made in the new workshop recently built and now being equipped at Spokane. The following figures from the annual report of the fire chief show the difference in cost of maintenance between motor and horse equipment:

Automobiles.	
Total maintenance, 1912, nine pieces, for gasoline, oils and repairs	$1,692.40
Average cost a machine a year	188.00
Total miles travelled	15,684
Average cost a mile	$.10
Horse Equipment.	
Total cost for 17 pieces, feed, shoeing and repairs	$7,339.19
Average cost a piece of apparatus	431.00
Total miles travelled	4,314
Cost a mile	$1.70

A combined hose wagon and pumping engine purchased recently from the Robinson Fire Apparatus Company at a cost of $8150 will replace four horses and two pieces of apparatus at the No. 10 station, and one driver will do the work that formerly required three men, a driver, stoker and engineer.

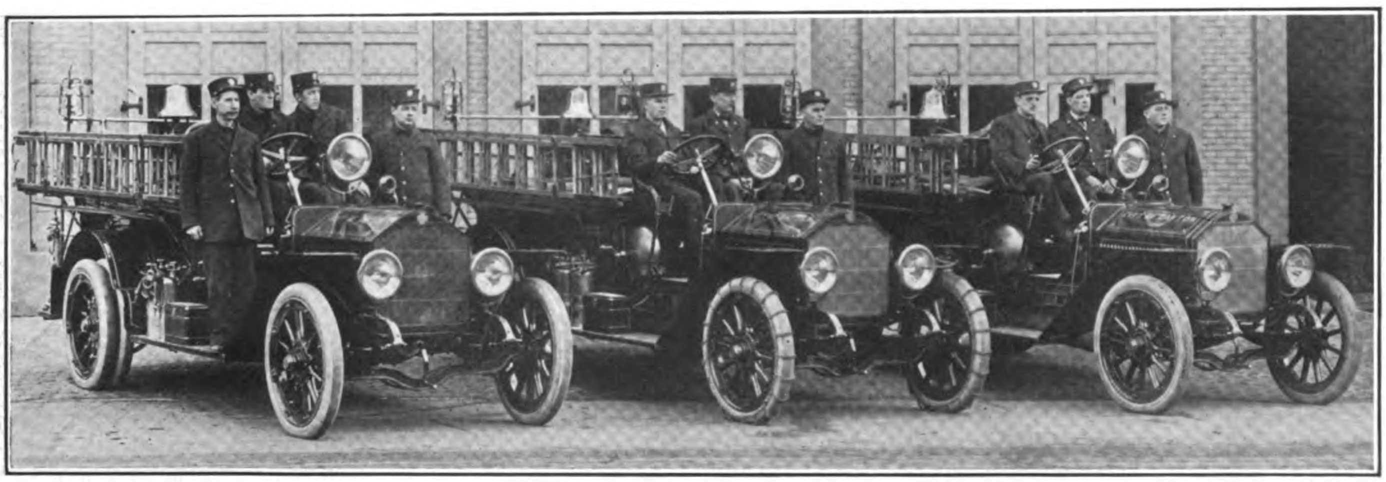
USE APLCO LIGHTING SYSTEM.

Three American-LaFrance Fire Cars in Dayton, O., Equipped with Home Product.

An accompanying illustration presents three of the American-LaFrance fire wagons in service with the department at Dayton, O., and as may be expected all three are equipped with the Aplco electric lighting system made by the Apple Electric Company of that city. In addition, these vehicles utilize the Dayton airless tires, made by the Dayton Airless Tire Company, also of that city.

The cars are the product of the American-LaFrance Fire Engine Company, Inc., of Elmira, N. Y., and are what is known as the type 10 combination chemical and hose wagon. The motor is a four-cylinder unit with bore of 5.5 inches and stroke of six, rated at 75 horsepower, brake test. The wheelbase is 140 inches, and the equipment, other than that mentioned above, includes a 40-gallon chemical tank, capacity for 1200 feet of 2.5-inch hose, 20-foot extension ladder, 12-foot roof ladder, hand extinguishers, axes and crowbars.

Of course, the photograph was taken before the recent Ohio floods, in which Dayton suffered so severely, but it serves to indicate the progressiveness that is manifested by the city in this department.



Three American-LaFrance Combination Fire Wagons in Dayton, O., Fitted with Aplco Lighting System and Dayton Airless Tires.

BUYING NO MORE HORSES.

Commissioner Johnson Announces Fire Department Will Be Completely Motorized in Five Years.

Fire Commissioner Johnson of the New York City fire department announces that no more horses will be purchased and that those now in service will be eliminated as fast as possible, automobile apparatus being substituted. He states that it will take about five years to completely motorize the department. There are now 1500 horses in use and 100 motors already have supplanted many of the animals. Before the end of the current year 100 more automobiles will be acquired. The equipment now consists of 850 pieces.

Horses die or go out of service in other ways at the rate of from 40 to 70 a year. As fast as they go they will be replaced by motors. The gradual conversion will cost about $2,500,000, and Commissioner Johnson says the money will be forthcoming at the required time. The attractive features of the change are found in that although the initial outlay is greater the ultimate cost is less, and the fire loss will be reduced because of the increased speed. Twelve tractors have replaced horses and 10 more will be delivered this year, while contracts for 28 others have been made.

FIRST IN THE UNITED STATES.

Niagara Engine Company in New London, Conn., Claims to Have the Original Motor Apparatus.

The recent 63d anniversary celebration of Niagara Engine Company No. 1, New London, Conn., was made particularly notable by the distribution of souvenirs commemorating what is claimed to be the first piece of motor apparatus ever put in service by an American fire department. This is the motor combination chemical and hose car, purchased of the American-LaFrance Fire Engine Company, Elmira, N. Y., and placed in active service Sept. 15, 1902. To each of the city officials a knife was given, bearing on one side a representation of the original automobile chemical, with the words, "First in the United States," and the date of its purchase. On the other side of the knife was a representation of the new triple combination pump, chemical and hose car, purchased the latter part of 1912 from the same company.

The old car does not look much like the apparatus in service today, but it is still doing duty, although it has never had a thorough overhauling. The machine is said to be the first piece of motor apparatus produced at the American-LaFrance factory, and is a steam propelled chemical with a Mason water-level type boiler, developing about 15 horsepower and giving about 20 miles an hour on level roads. Loaded the vehicle weighs 8000 pounds. Steam must be maintained under the boiler at all times and it takes about one minute to get up a running pressure. The members of the company, most of whom are skilled machinists, have had charge of the car, with the result that it has seen uninterrupted service and averaged about 75 runs a year since it was installed. The new machine is of 83 horsepower with capacity for 1000 feet of 2.5-inch hose and is equipped with a 40-gallon chemical tank.

It develops that the Niagara company has the oldest active fireman in the United States in George H. Powers, who has performed duty with the company for 53 years. He enjoys the unusual distinction of having worked at fires with the earliest hand drawn apparatus, then with the horse drawn vehicles and now with modern motor driven machines. It will be conceded that he is keenly aware of the progress made in fire fighting during the last half-century.

B. A. Gramm's Steel Dumping Truck in Service with the City of Seattle, Wash.

STEEL DUMPER FOR ROAD WORK.

City of Seattle, Wash., Acquires One of the New 3.5-Ton B. A. Gramm Trucks.

An accompanying illustration presents one of the new 3.5-ton B. A. Gramm trucks, made by the Gramm-Bernstein Company, Lima, O., in service with the street department in Seattle, Wash. It will be noted that the chassis is fitted with a rear dumping body and it is used in the hauling of sand, stone, etc., in road building work in the city and vicinity. It may be added that the dumping mechanism is operated by hand and the body is constructed of steel.

The 3.5-ton chassis is fitted with a four-cylinder motor, with cylinders cast in pairs, the bore being 4.5 inches and the stroke 5.5. The clutch is a multiple disc type and the transmission affords four forward

speeds and reverse. The gears are always in mesh, save when the machine is driving on the high speed, those on the main shaft being carried on roller bearings, and the dog clutches being secured by six splines instead of the usual keys. Another feature of the design is the use of the Gray & Davis electric lighting and starting system, the storage battery of which furnishes current for ignition for an Atwater Kent unisparker.

BUYS TEN MORE GARFORDS.

New York Police Department Finds Trial Machines Present Decided Saving for Year.

Police Commissioner Rhinelander Waldo of New York City, has awarded a contract to the R & L Company, eastern distributor for the Garford Company, Elyria, O., for 10 more Garford motor driven patrol wagons, to be delivered within 60 days. The police department already has three Garford machines and the big saving they have effected over the horse drawn wagons has convinced Commissioner Waldo that a complete motor equipment would be advantageous and economical for the city.

The following statistics, taken from the annual report of the police department for 1912, are extremely interesting and afford a reliable means of comparison between motors and horses:

Three motor patrol wagons were purchased and placed in service during 1912, replacing nine horse drawn patrol wagons and effecting a saving as shown below:

1911.		
Boarding 21 horses at $30 a month	$7,560.00	
Shoeing 21 horses at $5.50 a month	1,386.00	
Repairs to nine patrol wagons, $35 a year	315.00	
Repairs to nine sets of harness, $5 a year	45.00	
Eighteen patrolmen's salaries at $1400 a year	25,200.00	
Total		$34,506.00
1912.		
Automobiles kept in station house	......	
Tires, 48 at $37.05 each	$1,778.40	
Gasoline, oil and grease	595.00	
Nine patrolmen's salaries at $1400 a year	12,600.00	
Total		$14,973.40
Saving		$19,532.60

From this it will be seen that three motor wagons saved $19,532 in a year and no doubt when the additional 10 now ordered have been delivered and placed in service the resulting economy will be correspondingly greater.

NOTES FROM VARIOUS CITIES.

Fords in Police Department—Salt Lake City has placed in service two Ford cars, made by the Ford Motor Company, Detroit, for the use of the police department for making emergency calls. The plain clothes men will utilize the cars in their work, which will facilitate speed in getting to the scene of trouble when hurry calls are received.

Ahrens-Fox for Detroit—The Detroit fire department has put in service what is said to be the largest combination hose and chemical wagon ever built. The machine was made by the Ahrens-Fox Company, Cincinnati, O., and is equipped with a complete electric lighting plant, having two dynamos which are run by the gasoline engine. Three powerful searchlights are part of the apparatus, as is also a portable searchlight which will be used to light up ruins and smoky places. The wagon will carry 1500 feet of hose and a 50-gallon chemical tank.

Adams for Olean, N. Y.—A practical as well as an extremely striking motor chemical and hose wagon has been delivered to the fire department of Olean, N. Y., by the Adams Bros. Company, Findlay, O., maker of Adams trucks. The apparatus is mounted on a 1.5-ton chassis, and in addition to a 40-gallon chemical tank, is equipped with 200 feet of chemical hose, a 250-foot extension ladder, two fire axes, crow bars, lanterns, searchlight, etc.

Dubuque Motorizing Fire Department—The officials of Dubuque, Ia., have purchased a new triple combination chemical engine, hose wagon and fire engine of the Robinson Fire Apparatus Manufacturing Company, St. Louis, Mo., at a cost of $9000. The pump is capable of delivering more than 1000 gallons of water a minute. In the matter of furnishing fire protection to its citizens, Dubuque has rapidly come to the front among Iowa municipalities. On account of the hills and other natural conditions, automobile engines are said to be so much more suited to the needs of the fire department than the old horse drawn vehicles that many members of the city council are in favor of motorizing the entire equipment.

Lowell Adds Two Makes—The city of Lowell, Mass., recently put into service two pieces of motor fire apparatus. One is a Seagrave combination hose and chemical wagon, made by the Seagrave Company, Columbus, O. It has a six-cylinder, air-cooled motor and is electrically lighted throughout. The chemical tank has a capacity of 40 gallons and other equipment includes 200 feet chemical hose, 100 feet 2.5-inch fire hose and 36-foot ladder. The second machine is a Robinson, made by the Robinson Fire Apparatus Manufacturing Company, St. Louis, Mo. This is a powerful machine, capable of travelling 60 miles an hour and fully equipped and carrying 18 persons it weighs 10,450 pounds. It was the 172d Robinson car of its type constructed, but was the first installed in the East.

In the Market—The following cities are in the market for motor apparatus of various descriptions: Fond du Lac, Eau Claire, Janesville and La Crosse, Wis.; Traverse City and Kalamazoo, Mich.; Elkhart, Goshen, LaPorte and Michigan City, Ind.; Burlington, Davenport, Cedar Rapids, Des Moines, Fort Dodge and Marshalltown, Ia.; Oakland, Cal.; Westfield, Mass.; Berkeley, Cal.; Marshfield, Ore.; Springfield, Ill.; Pasadena, Cal.; Elmira, N. Y.

THE A B C OF MOTOR TRUCK IGNITION.

Part VIII---Outlining the Various Systems Utilized with the Commercial Gasoline Vehicle Their Components and Application in Practise---Explaining the Function of the Master Vibrator and Operation of Plug Transformers.

By C. P. Shattuck.

SYNCHRONIZATION is obtained by other units than the distributor, which method was discussed in the previous installment. It has been explained that with multiple cylinders it is important that the spark occur in each in proper order; that is, the compressed mixture should be ignited with each piston in exactly the same position relative to the crankshaft. While it would appear that a slight variance, a fraction of a second for example, would not affect the operation of the motor, this is not borne out in practise and especially is this found to be the case with high speed engines.

Fig. 36—K-W Master Vibrator.

When it is considered that some four-cylinder motors are capable of as high as 1700 revolutions a minute, it is easily seen that with one or more of its explosions occurring later than the others the impulses to the crankshaft are unevenly divided. Such a condition tends to destroy the balance of the engine, which at the best is not as perfect as with the six-cylinder unit. While vibration, especially at high speeds, with a four-cylinder motor is largely due to connecting rod angularity, which takes place twice each revolution, much of the unevenness may be caused by lack of uniformity in the ignition.

Value of Synchronization.

That the modern motor is more efficient than the earlier types is due in a great measure to the perfection of the magneto, which makes for synchronization of the spark mechanically. With the high-tension instrument the primary current is interrupted at the proper instant, and a distributor incorporated with it insures perfect timing of the spark.

There are, however, a large number of commercial vehicles in service which employ multiple-unit coils and utilize in connection with these a chemical source of current or a low-tension magneto. With the latter type the current is built up or converted into high-tension by the coils and synchronization is secured through the use of a master vibrator or by the distributor as previously explained. While a new high grade multiple-unit coil gives satisfactory results, practise bears out the statement that in time the vibrators lose their elasticity and that it is almost impossible to adjust the different units so that their speed will be the same. This lack of uniformity, together with the desire to economize room on the dash, has been responsible for the very general adoption of the magneto with a single coil either of the vibrating or non-vibrating type.

One of the most important functions of the master vibrator, in addition to synchronizing the spark, is that of regulating its size. With the ordinary type of multiple-unit coil in service the size of the spark will vary according to the adjustment and condition of the contact points. The results obtaining with a weak spark are well known by the operator. Not only is it difficult to start the motor, but its maximum efficiency is not developed because the charge is not ignited properly. And current may be wasted through incorrect adjustment of the contact points as well.

Function of Master Vibrator.

The master vibrator, as the name implies, replaces the vibrators of the coils, but the latter are essential to the operation of the system. Instead of four vibrators being utilized, but one is employed, the master unit, and as it performs the work of breaking the primary current at the proper instant it is obvious that synchronization must result, a condition that is not always possible when the other system is installed.

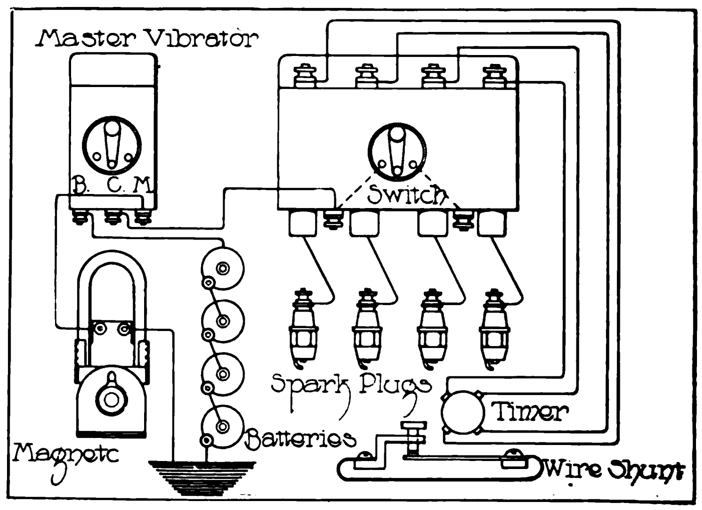


Fig. 37—Wiring Plan of K-W Master Vibrator with Magneto and Dry Cells, Also Showing Wire Shunt.

There are a number of master vibrators marketed and three conventional types are shown at Figs. 36,

39 and 43. Some idea of their compactness may be secured from the dimensions of the J & B instrument, made by the J & B Manufacturing Company, Pittsfield, Mass., and illustrated at Fig. 43, this being three inches wide and five high. Master vibrators are not always rectangular in form, as will be noted by the Briggs & Stratton, shown at Fig. 39. This member is circular and is 5.25 inches in height and 2.25 in diameter.

The J & B employs a triple-pole electro magnet, which the maker holds is more efficient than other forms in that it provides a greater surface for magnetic traction, as well as gives two independent magnetic circuits. It is also pointed out that in the construction opportunity for sticking vibrators is eliminated. The magnetic core is built up of laminated silico vanadium steel, which is held to be specially efficient for magnetic purposes where an alternating current is utilized.

Installing Master Vibrator.

A two-throw switch is utilized in connection with the master vibrator, as will be noted by referring to Fig. 36, which illustrates the K-W, made by the K-W Ignition Company, Cleveland, O., and while designed especially for model T Ford cars, is applicable to other multiple-cylinder motors. It may be employed with a set of dry cells or a storage battery, with a battery and a low-tension magneto, or with the magneto alone. This is demonstrated by the wiring plan presented at Fig. 37, which shows the K-W master vibrator utilized with a low-tension magneto by the K-W company with a set of dry cells as an auxiliary.

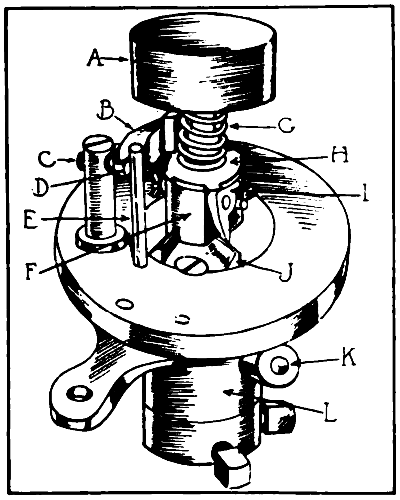


Fig. 38—Circuit Operating Mechanism of Rhoades' System.

It will be noted that the master vibrator is provided with three terminals and that these are marked B, C and M respectively. One wire from the dry cells is led to the post marked B (battery), and the other lead is grounded. The magneto is connected in circuit in a similar manner, one wire being grounded and the other connected to the terminal marked M (magneto).

Need of Wire Shunt.

As previously stated the master vibrator does not replace the usual coil. The latter is essential, but its vibrators must be short circuited or shunted as shown in the drawing at Fig. 37. This is accomplished by closing the circuit between the primary terminal post and the adjustable platinum contact screw by connecting these members with a piece of copper wire. While practically the same results may be obtained by screwing down the screw member until the contacting points are practically as one, the wiring method is recommended because there is apt to be more or less resistance when the platinum points are utilized, especially if they be pitted.

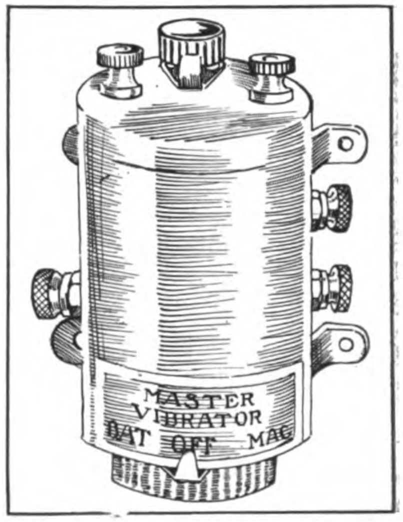


Fig. 39—Briggs & Stratton Master Vibrator.

The connections to the commutator and primary leads to the coil are not disturbed as the current is shunted to the master vibrator and the break in the primary circuit is made by the timer as usual. A wire is led from the battery terminal of regular coil to the post marked C (coil) on the master vibrator. The secondary leads are not changed in any manner, as it will be seen that the connections are the same as if the master vibrator were not used. The switch on the latter is employed to start and stop the motor and that on the regular coil is thrown to the lead connecting the coil with the master vibrator.

Wiring for Ford Cars.

When the master vibrator is fitted to Ford cars utilizing the flywheel type of magneto, the terminal M is connected with the magneto. A wire is led from the terminal on the coil switch marked "Magneto," to the post C on the master vibrator. Both the switches are consequently thrown to the "Magneto" position and that on the master vibrator is employed for starting and stopping. If dry cells or a storage battery be utilized as an auxiliary or for starting, one wire is connected to the B terminal on the master vibrator and the other grounded. A little study of the wiring plans presented herein should enable the reader to wire either system..

Rhoades' Unit Spark System.

The Rhoades' unit spark system, produced by the New York Coil Company, is of the distributor type and the breaking of the primary circuit is accomplished mechanically. The low-tension current is built

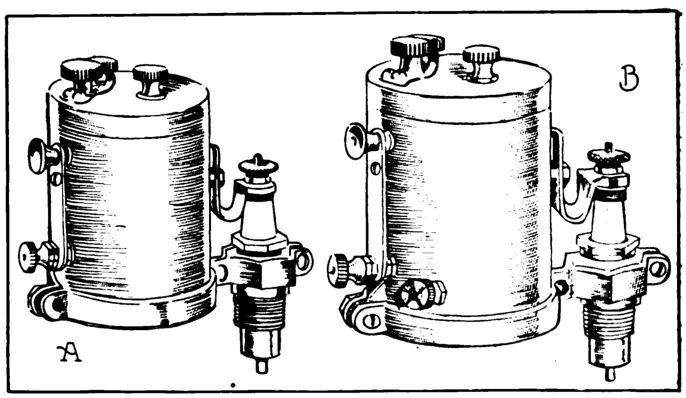


Fig. 40—Types of Plug Transformers: A, Briggs & Stratton Designed for Single-Cylinder Motors; B, Construction Adapted to Multi-Cylinder Engines.

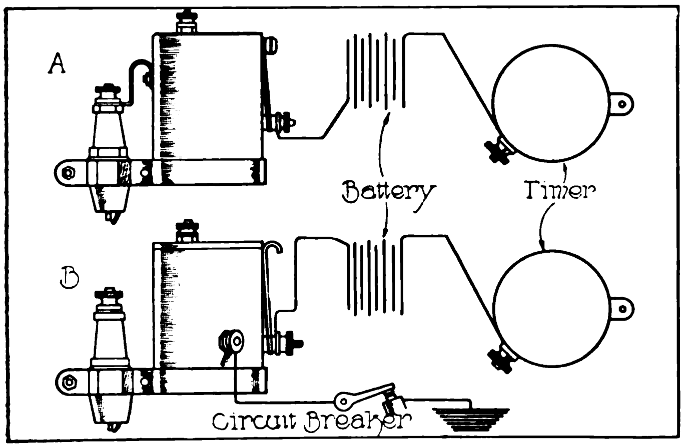


Fig. 41—Presenting Wiring Plans of Types A and B Briggs & Stratton Plug Transformers.

up by a non-vibrating coil and supplied to the various cylinders in proper order by a distributor which is incorporated with the circuit breaking mechanism. It is claimed that the system, current for which is supplied by a battery, will provide a very hot spark and that synchronization is secured through the construction of the circuit breaker.

The latter is illustrated at Fig. 38 with its cover removed and components lettered. The primary circuit is established and broken between the platinum point on the inner end of the adjusting screw C and the point B on the spring. Normally these members are separated. Their operation is as follows: The triangular pivot piece is tripped by the hardened projection J, and one, two, four or six of these are utilized, according to the number of cylinders. The upper end of I raises the disc H against the action of the coiled spring G, immediately under the distributing cylinder, and at the same time this disc is made to revolve by means of a pin. The disc H has projections, these corresponding to the number of cylinders, and the piece I allows it, under action of its spring, to snap back into the position from which it has been raised by I.

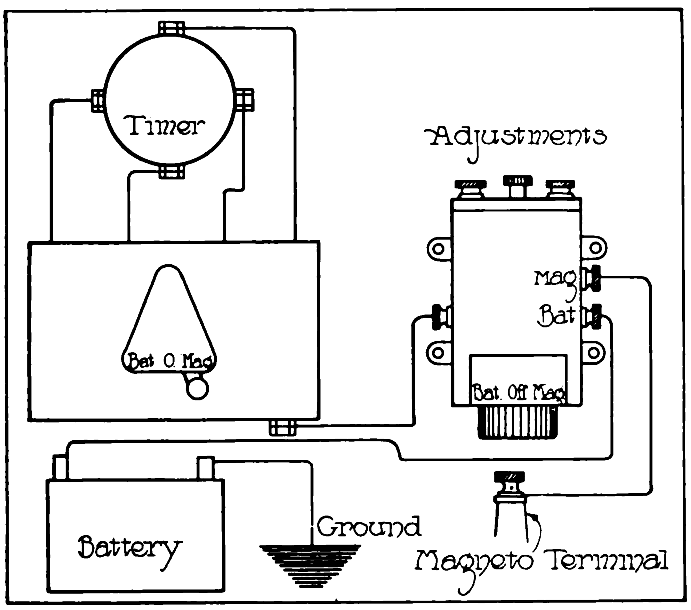


Fig. 42—Illustrating Connections of B. & S. Master Vibrator When Employed with Low-Tension Generator Utilized on Ford Cars, and with a Storage Battery.

As it snaps back one of these projections on the disc H engages on the slanting lip, which is formed on the flat lever D. To the latter is attached the contact spring B.

As the piece H snaps by the lip on B, it forces the contact members into engagement, establishing the primary circuit and keeping same closed during the transforming of the low-tension current into high by the coil. The upper portion A is the distributor, into which the secondary current is led through a pressed steel contact member, not shown in the drawing.

The combination unit is mounted on the timer shaft in the same manner as a timer or distributor and is provided with detachable secondary terminals, spring retained. The screw C is adjustable and by moving this member in or out the variance in voltage of the battery in service may be compensated for. The system is designed to be operated by a six-volt storage battery or a group of dry cells.

Plug Transformers.

There are several types of what are termed plug transformers, in which the vibrating coil, primary switch and secondary connection are a unit and the spark plug is secured to the construction. Two types of these are shown at Fig. 40, that at A being adapted to a single cylinder motor and more particularly designed for marine or stationary engines in that the switch is mounted on the transformer. It could be employed, however, with a single cylinder motor by installing a switch on the dash and carrying wires to the primary connections. That illustrated at B is suitable for service with any number of cylinders, but is provided with the same switch construction.

Fig. 43—J & B Master Vibrator.

The advantages claimed for the transformer, in addition to economy of current and a hot spark, are: Elimination of the usual secondary wires, and that only one wire is required, that running from the binding post at the base of the switch to the battery. The wiring plan is shown at Fig. 41 A.

The type B differs from that previously described only in the primary connection, which is brought out to a separate binding post instead of being grounded on the plug bracket. This adapts it to use with a ground circuit breaker and also on motors having more than one cylinder. The wiring plan is indicated at Fig. 41 B and it will be seen that one wire runs from the binding post of the switch to the battery. Another wire is connected between the circuit breaker and the other binding post on the transformer. The final connection is made between the remaining terminal on the battery and that on the timer. The same

wiring plan is utilized with either single or multiple cylinders, except that the timer occupies the place of the circuit breaker where more than one cylinder is employed. These types of transformers are illustrated to show the varying methods of obtaining a spark at the plugs.

Briggs & Stratton Vibrator.

At Fig. 39 is illustrated the master vibrator made by the Briggs & Stratton Company, Milwaukee, Wis., maker of the transformers mentioned above. It differs from those previously described in that it is circular and is very compact, being 4.25 inches high and 2.5 in diameter. It is secured to the dash by suitable brackets integral with it and the case is constructed of vulcanized fibre treated with a weather proof compound, and finished in black.

Among the advantages of the vibrator claimed are that pitting of the positive and negative platinum contact points is prevented, as the switch automatically reverses the direction of the current every time it is utilized, and that the motor cannot be started twice in succession on the same polarity of primary current. The adjustment of the vibrator is obtained by removing the cover, which is retained by two knurled screws, exposing a similar member. The connections and wiring plan are presented at Fig. 42, which illustrates that employed with Ford motor cars utilizing a low-tension magneto generating an alternating current.

As previously stated there are a number of transformers in which the spark plug is a part of the construction, but to describe these would be a repetition of those outlined in that the principle involved is similar.

(To Be Continued.)

Ed. Note—The next installment will deal with make and break ignition systems, also the low-tension magneto.

REDUCING DELIVERY COST.

St. Paul Concern Reduces Figure to 3.5 Cents a Package by Using KisselKar.

The Golden Rule department store of St. Paul, Minn., which is using four 1500-pound KisselKar trucks, made by the Kissel Motor Car Company, Hartford, Wis., in its delivery service, has issued a statement which shows that one of its machines is delivering at a cost a package of less than 3.5 cents. According to the record, the total cost for one year of the KisselKar in question was as follows: Gasoline, $283.44; lubricating oil, $49.20; tank recharges, $12; speedometer, chains, other articles and incidentals lost or broken, $33.90; tires, $474.48; tire and tube repairs, $91.65; driver's salary, $700; helper's salary, $260; total, $1804.67.

The number of packages delivered was 86,432, and an average of 49.5 miles was covered each day. When the truck was first put at work it handled 5428 packages a month. Every month has shown an increase until the number was 9109 packages in December, using the same amount of help and covering a slightly smaller area of territory than at first. The average daily delivery was 282.5 packages.

PACKARD HAULS MOTOR TRAIN.

Does the Work of Fifteen Pairs of Mules in Transporting Building Material.

Motor trucks are rapidly supplanting the mules in the mountains of North Carolina. F. L. Seely, who has charge of the construction work at Grove Park inn, on the slopes of Sunset mountain at Asheville, N. C., has adopted a Packard truck, made by the Packard Motor Car Company, Detroit, to do the hauling for that building.

The structure is being built of rough stones gathered on the mountain sides for several miles around. These are hauled on drags, sleds and wagons to the automobile road and there loaded on a motor train of 15 wagons and transported to the inn, three miles below, the Packard machine acting as an engine to the train. The truck does the work of 15 pairs of horses or mules and has been in this service for the past five months. It is working regularly from 7 in the morning until 6 at night and less than five hours have been lost during this period in making adjustments.

KNOX IS FARTHEST NORTH.

Two-Ton Vehicle Performs Satisfactory Service on Difficult Alaskan Trail.

What is claimed to have been the farthest north ever reached by any motor truck in the Western Hemisphere is the record accomplished recently by a Knox truck, made by the Knox Automobile Company, Springfield, Mass., and in the employ of the White Pass & Yukon Railroad Company in Alaska. The machine was put in operation on the Dawson-Overland trail in October, 1912, and in spite of the severe conditions along the trail, has made as high as 85 miles a day with a full two-ton load.

In the middle of December a load of Christmas freight was rushed from White Horse to Minto, a distance of 175 miles, in 2.5 days, a large part of the route having never been travelled by a motor vehicle before. Incidentally on this trip the machine covered one of the most hilly stretches of trail in the country in five hours, taking all the hills under its own power with full load of two tons, while a high powered touring car in attempting the same trail a week later required nine hours and was forced to make the hills with the assistance of block and tackle.

Farm Motors at St. Petersburg Show—It is announced that the committee of the forthcoming automobile show in St. Petersburg, Russia, in May, has decided to grant foreign exhibitors a premium of 1000 francs for each agricultural tractor installation—tractor and plow—or other agricultural machines shown.

New Commercial Car Accessories

O-Tak-A Tire Remover.

Removing large pneumatic tires is troublesome, especially when the rims have become rusted and the shoe is what is termed as frozen. Under the latter condition the casing is subjected to more or less stress in the attempt to break its contact with the rim and sometimes carelessness results in loosening the fabric in the side walls. The O-Tak-A tire remover was designed for this purpose and among its qualities is that of accomplishing the work without injuring the tire. It is adapted to clincher shoes by slipping a little attachment over the nose of the plunger, and is also applicable to quick detachable and demountable rims. When employed on clincher shoes it not only forces the bead away from the rim, but lifts the casing, permitting easy removal of the shoe. It is especially adapted to quick detachable rims in that actuating the lever makes it possible to displace easily the locking ring. A feature of the tool is that it locks automatically, allowing the operator to use both hands. The working parts do not come in contact with the paint of the wheel, acting only on the rim. The O-Tak-A comes in an aluminum or nickel finish and is marketed by J. W. Grumiaux, sales agent, Le Roy, N. Y.

J-M Fire Extinguisher.

The H. W. Johns-Manville Company, New York City, is marketing the J-M fire extinguisher, which comprises a compact metal tube filled with a dry powder guaranteed to put out any fire in its first stage, arising from gasoline, benzine, calcium chloride, etc., if utilized according to directions. The nature of the powder is such it will not injure the paint or upholstery of a car and it is also warranted not to freeze or cake within the container. It is constructed in a special size for automobiles and may be stored easily owing to its compactness.

Bay State Sticket Wrench.

The Bay State Sticket wrench, marketed by G. A. Cutter, sales agent, Taunton, Mass., comprises a double ended ratchet wrench, strapped to seven strong stamped steel sockets, strung on a square steel shank. One end of the wrench fits the shank and the other the sockets. The wrench also fits four sizes of nuts, and with the sockets 11 different sizes of nuts and cap screws. The reversible ratchet wrench is secured to the shank by a substantial leather strap and a washer prevents rattling. A 1.25-inch ball is fitted to one end of the shank, but is removable when the sockets are displaced. The other end of the shank has a ball stop and a spring ball for holding the socket in position. The wrench is adapted for a large variety of work and may be carried easily in the car. Extra sockets are supplied.

Reacto Electric Horn.

The Holtzer-Cabot Electric Company, Chicago and Boston, has perfected an electric horn which although moderately priced, is constructed of high grade material and with that care for which the products of this concern are noted. It is of the simple hammer blow type, a construction that secures a direct application of the power to the diaphragm and consequently instantaneous response. The heavy armature or hammer strikes the 5.5-inch diaphragm squarely and rebounds so quickly that rasping or discord in the sound is eliminated. The tone is clear and penetrating, but not harsh. One of the qualities of the horn is that it will respond to battery voltages 25 per cent. below normal and therefore does not require adjustment, although provision is made for altering the positions of the heavy platinum contact points. Sparking is prevented by the use of a well designed condenser. The binding posts are within the rear casing, and all carrying parts are insulated from the main structure. The horns are produced for any specified voltage from four to 125, thus adapting them for electric commercial vehicles, as well as gasoline cars. The standard finish is japan, baked on, with nickel throat, but it is also finished with polished brass throat, or full nickel or brass.

Thomas' Anti-Rim Rust Paint.

Rust is not only detrimental to the tires, but makes it difficult to remove them. The Anti-Rust Paint Company, Akron, O., is manufacturing Thomas' Anti-Rim Rust Paint, which is a compounded metallic liquid preparation, containing para rubber and graphite. It is utilized for painting the rims, preventing rust, and is also designed for painting the rim bolts and lugs of motor trucks. Another quality of the paint is that it may be employed between the leaves of springs. It is applied easily and is held to be very durable.

Vellumoid.

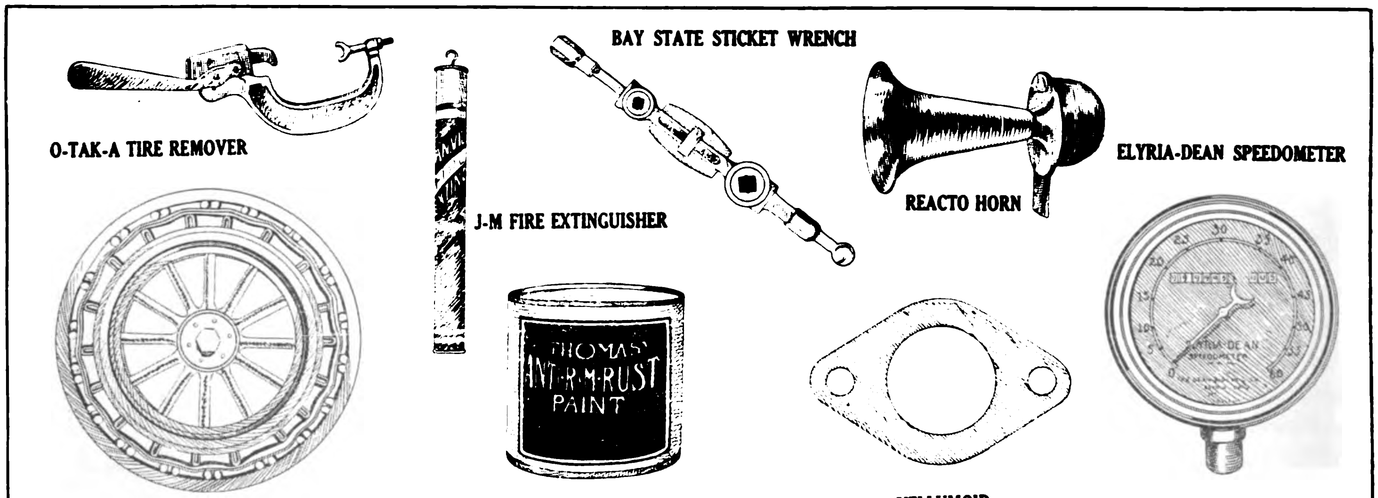
Vellumoid is a patented gasket material marketed by Charles D. Brown & Co., 49 Federal street, Boston. It is very tough, but pliable, and is impervious to the action of gasoline, kerosene, oils, water, etc. It is particularly adapted to motor cars for gaskets, either in hot or cold places, but is not suited to hot steam under pressure. It comes in sheets, or rolls, and is constructed in differing thicknesses to meet individual requirements.

Favary Tire.

The Favary tire, manufactured by the Favary Tire Company, Inc., 111 Broadway, New York City, is designed for commercial and pleasure vehicles, and resiliency is secured through pliable bands under tension. There are two of these rugged, water proof members, between which is placed a series of aluminum blocks secured by tubular rivets. The large heads of the latter rest upon the bands and their tubular section is opened on the aluminum blocks. The tread is detachable and the locking mechanism is positive. The principle involved in operation is as follows: Immediately under applied load the bands dip downward, while adjacent thereto there is an upward movement, due to the increased tension of the bands. It is held that the tension is quickly and easily adjusted to conform to the character of the roads and that resiliency is the chief feature of the tire.

Elyria-Dean Speedometer.

The Dean Electric Company, Elyria, O., is manufacturing the Elyria-Dean speedometer which is designed to withstand severe service and to record accurately the speed of motor vehicles. It differs from instruments working on the centrifugal principle in that four steel balls operate radially in grooves, so as to raise a cup shaped member and move the indicating hand over a long uniformly divided scale. This is accomplished without compensating springs or other modifying means being employed. The dial is finished in black, a reflection proof color, and the markings, letters, etc., are in white, making for easy readings. The total and trip members are actuated by separate mechanisms, serving as a double check on the mileage.



Some New Accessories, Including O-Tak-A Tire Remover, Reacto Electric Horn, Thomas' Anti-Rim Rust Paint, Vellumoid, Bay State Sticket Wrench, Etc.

FOREIGN TRUCK NOTES OF INTEREST

TO TEST FOUR-WHEEL DRIVE.

French War Office Desires to Adopt This Type of Motor Vehicle for Army Service.

The French war office has announced that it will hold trials of four-wheel drive vehicles and carriers, which should give interesting results. The trials will be held with the idea of making some very large government purchases during 1913, the French war office authorities having expressed their desire to adopt this type of machine for army service. The most noteworthy of the conditions are the following:

The vehicles must not weigh more than 5.5 tons, and must be able to carry a two-ton load; all parts must be at least 30 centimetres high above the ground; bodies must be provided with sides 60 centimetres high and must be capable of accommodating 12 men; a winding gear or capstan worked from the motor must be provided for winding 50 metres of cable; each wheel, as well as transmission, must be supplied with a brake; carburetors must be automatic and be able to use gasoline, benzol and alcohol.

ELECTRICS VS. HORSES.

Comparative Figures in Street Cleaning Work as Evolved by Department in Berlin.

At Berlin, Germany, the department in control of the city highways has placed in service 18 electrically driven washing machines, while 10 horse drawn pieces are still in use. During the last year six horse drawn vehicles were equipped with motors and six additional motor machines were purchased. The department has published the following figures bearing on the relative efficiency of motors and horses, the figures representing cost of operation for an eight-hour work day:

Electric Driven Machine.	
Driver's wage	$1.25
Electricity consumed, on the average 1.716 kilowatts an hour at 3.808 cents a kilowatt in eight hours	.52
Insurance of batteries against deterioration at $130.90 a year	.44
Repairs, figured on basis of past experience	.63
Amortization, figured at 15 per cent	1.49
More rapid consumption of rubber rollers owing to higher speed	.08
Total	$4.41

Horse Drawn Machine.	
Driver's wage	$1.12
Two horses, at $1.51 a horse	3.02
Repairs	.19
Amortization, figured at 10 per cent	.24
Total	$4.57

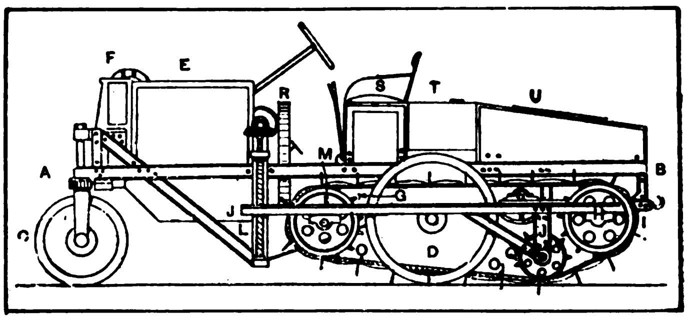
Commenting on these figures, the department points out that an electric machine cleans in an hour 6937 square yards of street surface, or in a day of eight hours, 55,496 square yards, at a cost, as shown, of $4.41, while a horse drawn machine cleans in the same time only 44,013 square yards at a cost of $4.57.

NEW THREE-WHEELED TRACTOR.

Lefebvre Product Recently Displayed at Agricultural Show in Paris, France.

Among the new agricultural motors revealed at the recent show in Paris, France, was the three-wheeled Lefebvre tractor designed for use in plowing or for hauling over soft ground. The accompanying rough sketch, which is reproduced from Motor Traction, a British magazine, indicates the construction and principle of operation, and it will be noted that the tractor is fitted with an endless chain arrangement carrying broad spike like blades which dig into the soil and provide additional traction. Of course, this arrangement is so contrived that it may be drawn up out of engagement when its service is not required.

The letters on the drawing have the following ref-



Sketch Presenting Principles of Construction and Operation of Lefebvre Agricultural Tractor.

erence: A B chassis, C steering wheel, D driving wheels, E motor (24-30 or 35-40 horsepower according to the type), F radiator, G transmission (affording four forward speeds ranging from nearly two miles to 5.5 miles an hour, and a reverse), H steel frame carrying two secondary shafts to which are fixed wheels I and J driving the endless chain. The frame pivots on the rear secondary shaft and the front portion is raised or lowered by the screw L, which is rotated by a bevel gear by means of a belt taken from the flywheel R.

When travelling on roads or in turning, the frame or chains are raised, and when working on the land the frame is lowered until the blades are sufficiently gripped in the soil to give the necessary adherence. M shows the position of a device for regulating the tension of the chain O, which is fitted with a chrome leather band, preventing it from coming into contact with the soil. The third wheel Q compels the blades to leave the soil almost vertically. T is the fuel tank and U the tool chest.

BELSIZE THREE-TON MODEL.

Type of Chassis Regarded by British Engineers as Possessing Particular Merit.

The Belsize Motors, Ltd., Manchester, England, is among the British constructors of commercial motor vehicles which have enjoyed wide recognition in Great Britain and its colonies. Many Belsize machines are being used by the government, particularly in the royal mail service, and these have given eminent satisfaction. The three-ton vehicle, shown herewith, is regarded by British engineers as possessing a number of features of merit.

The question of worm vs. chain drive is one that does not appear to have been solved definitely by a number of makers in Great Britain, and while this model is regularly supplied with the worm, an option of the chain is permitted. Of course, the body equipment is built to individual specifications, following the practise in vogue abroad.

Belsize Three-Ton Worm Driven Truck, Which Embodies Interesting Constructional Features.

Special attention is drawn by the maker to the deep radiator and the so-called Butler type of front axle. The latter differs from conventional practise in this country in that it is a straight forging. It appears to be made in two sections and the spring saddles are of separate construction, permitting easy removal and replacement in case of necessity.

Other features include the use of twin torque rods, locomotive type propeller shaft brake and a high pitched frame. The motor is a four-cylinder unit, of the T head type, with cylinders cast in pairs, the bore being 4.5 inches and the stroke five. Lubrication is by a gear driven pump. Ignition is by Bosch magneto. The clutch is a Hele-Shaw, and the transmission provides four speeds forward and reverse, with direct drive on the fourth. The wheels are of the artillery type, with 30 by four-inch solid tires in front and 34 by eight-inch dual members at the rear. The wheelbase is 138 inches.

HEAVY DUTY HALLEY TRUCK.

Interesting Six-Cylinder Machine Recently Introduced by Well Known Scotch Manufacturer.

One of the most interesting vehicles displayed at the recent show in Manchester, England, was the new Halley Colonial model, rated at six tons, made by Halley's Industrial Motors, Ltd., Yoker, Glasgow, Scotland. The machine is said to have been subjected to severe tests over all kinds of rocky, uneven and marshy land, carrying a maximum load of seven tons. As may be imagined, the construction is particularly heavy throughout, and it embodies a number of features that are of special interest.

In the first place, the motor is a six-cylinder unit, with bore of five inches and stroke of 5.5. The cylinders are cast separately with inlet and exhaust valves on opposite sides. The engine is said to have developed 75 horsepower on a brake test, and differs but slightly from that utilized in the Halley fire engines. The speed is controlled by a centrifugal type governor. Ignition is by Bosch high-tension magneto, with storage battery and coil as an auxiliary.

The clutch is a cone. The transmission gives four speeds forward and reverse, and the gears are in constant mesh, being brought into action through dog clutches. The differential is of the bevel pinion type and may be locked by a separate dog clutch to insure an even drive from both wheels on soft or slippery ground. Final drive is by side chains, and these with the differential shaft sprockets and all gearing are enclosed in oil tight cases. Exact alignment of the rear wheels is secured by strong radius rods, with a bevel and cross shaft compensating device to insure equal tension on the driving chains.

The driving wheels are five feet in diameter and 12 inches across the treads. It ought to be mentioned that both front and rear wheels are of the steel plate disc type. The rear members are provided with removable diagonal strips around the circumference to prevent slipping, and there are eight hand holes on the outside for riveting on these strips when necessary. The wheels revolve on a substantial nickel axle, with extra long bearings at the hubs, outside of which are mounted a pair of large winding drums, made to carry 150 feet of strong steel wire rope. These may be used for hauling purposes, but are specially intended to assist the vehicle in extricating itself from mudholes and the like, and the maker states that they are

capable of hoisting vertically a weight equal to that of the combined machine and load. The use of such large driving wheels has necessitated the introduction of a new reduction gear, which has been made the subject of a patent, and which is held to overcome the speed reduction difficulty.

The front wheels are three feet 10 inches in diameter and six inches across the plain treads. The front axle is of special construction, and being pivoted at the centre gives a three point suspension to the chassis. This is held to permit the vehicle to pass over obstacles 16 inches in height without any distortion of the frame. Above the axle is a strong built-up semi-elliptic spring, free to move radially on a central pivot, permitting the axle to have free vertical movement at either end, while its longitudinal position is maintained by a cast steel horn block bracket, in which the axle is free to move up or down.

FUEL IN SOUTH AFRICA.

Experiments With Motor Transportation Indicates Alcohol Must Be Used for Desired Success.

At a recent meeting of the North Charterland Exploration Company, Ltd., at London, the chairman, Sir H. F. Wilson, stated that the directors of the company felt recourse must be had in South Africa to motor trucks in order to reduce the time taken between Fort Jameson and the river in the transportation of cotton. The time now taken by wagons and carriers is from four to five weeks and unless this time could be reduced the company would find it necessary to secure a large number of teams and native carriers at exorbitant prices. Some experiments have been made with motor traction, the demonstrations proving that to enable it to become commercially practicable the fuel to be used must be alcohol, which must be distilled locally.

The company had, therefore, he stated, obtained from the administration of Northern Rhodesia permission to prepare and make use of denatured alcohol for transport purposes under certain necessary restrictions without payment of excise duty. It is proposed, in co-operation with the West Nyassaland Estates, Ltd., to establish a distillery plant at Fort Jameson to make alcohol for road motor and agricultural machines. This will be the first plant of its kind in South Africa and by its means regular motor transportation will be maintained in the dry season between Fort Jameson and Tete. The details are now under consideration.

GENERAL NEWS FROM ABROAD.

Motor Mail Service in India—A new motor mail service has been established in British India, operating between Trichinipoly and Puddukotta, a distance of about 33 miles. Four cars are utilized, each carrying a post box available to the public at the recognized stopping places.

Seeking Substitute Fuel—A special committee representing the Royal Automobile Club of Great Britain, the Automobile Association, the Commercial Motor Users' Association and the Society of Motor Manufacturers & Traders, has been appointed to investigate the subject of fuel. The outcome of the committee's deliberations thus far is a recommendation that further investigations be made into the matter of production of alternative fuels and particularly of benzol.

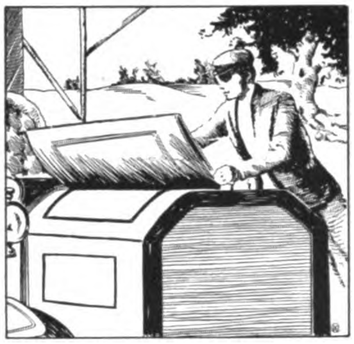
Producing Road Sweeper—One of the first motor road sweepers to be built for service in Great Britain has been produced by the Lacre Motor Car Company, Letchworth, England, for use in Glasgow, Scotland. The motor is an 18 horsepower two-cylinder unit of the firm's standard type, and means are provided for operating the revolving brush through the action of a dog clutch.

Motor Plowing Competition—A proposition is under way for the holding of a motor plowing competition in connection with the jubilee agricultural exhibitin at Konigsberg, Germany, as a part of the Prussian centenary fetes.

Office Car for Savings Bank—Gebruder Stoewer of Stettin, Germany, has just completed an office car for the Municipal Savings Bank in that city, which is intended for use in connecting the central headquarters with the several branches of the bank. It comprises a safe and shelves for arranging any documents and books that are to be transferred, and is fully protected against intrusion while en route.

Motor Traction in Java—According to the Bulletin Commercial of Brussels, Belgium, experiments made in the interior of Java with two motor trucks for transportation work on the tea plantations of the Preanger as far as Wijnkoops bay, have resulted to the entire satisfaction of the planters. A plan is now under way to increase the number of cars to five, and it is held to be probable that before long the service will be extended to a number of places now inaccessible to railroads.

New Zealand Dairy Farmers—At a recent meeting of New Zealand dairy farmers in Christchurch, an agreement was reached to adopt motor vehicles in place of horse wagons for carting milk and cream to the creamery. The Central Dairy Company reported that the annual expense of transporting cream and butter by rail had been £1942, while the use of horses in bringing milk and cream to the plant had cost £897, not counting the item of £144 for feed and shoeing. It was the opinion of this concern that the motor vehicles not only would cost less, but would bring about a decided saving through their greater speed.



HINTS·FOR·PROPER MAINTENANCE

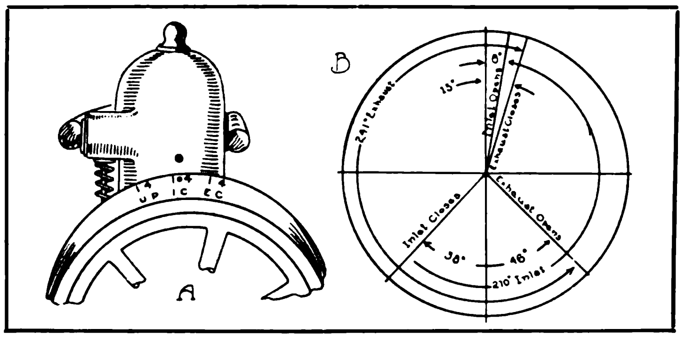
A Department for the Owner, Driver and Repairman.

TIMING WITH UNMARKED GEARS.

The correct replacement of the camshafts in the overhaul of a motor is a simple matter when the gears are marked and the majority of motors come from the factory with prick punches on the teeth of the gears. If they do not exist and the camshafts are removed without marking or the gears become broken in service it will be necessary to retime the valves and for this work the timing will have to be secured from the factory or agent.

In replacing the camshaft the gears should be so remeshed that the cam actuating the intake valve of the first cylinder begins to move and lift the valve when the flywheel is rotated a certain number of degrees.

Assume that the motor is a four-cylinder unit and



Valve Timing with Unmarked Flywheel: A, Showing How Cylinder May Be Prick Punched and Flywheel Marked After Degrees Are Laid Out by Diagram Indicated at B.

the valve timing is as follows: Intake opens at eight degrees past upper dead centre and closes when it is 38 degrees past lower dead centre. The exhaust opens 46 degrees before the lower dead centre and closes 15 degrees past upper dead centre. This indicates that the exhaust opens early and closes late and that the inlet opens and closes late.

Laying Out Degrees.

Assume that the flywheel is 17 inches in diameter and that the valve openings are not marked upon its periphery. It is a simple matter to lay out the degrees or mark it by inches. The figures will be as follows: Inlet opens late 1.1875 inches, closes late 5.65625. Exhaust valve opens early 6.84375 and closes late 2.234375. Top and lower dead centres are essential and these may be secured by turning the flywheel until the pistons of the first and fourth cylinders are at the top. Mark the flywheel for these positions and make a prick punch on the rear cylinder as indicated at A in the accompanying illustration.

Next measure off 1.1875 inches on the periphery of the flywheel to the right as the inlet valve opens late. Turn the flywheel to the left until the mark registers with that on the cylinder and replace camshaft, meshing gears in such manner that the inlet valve of the first cylinder will begin to lift. After fitting the camshaft rotate the flywheel in the direction opposite to which it travels and then move to the left to make sure that the inlet valve of the first cylinder starts to lift when the mark on the flywheel coincides with that on the cylinder.

Marking the Flywheel.

The timing may be checked up for each valve to make sure the setting is correct by measuring off the distances on the flywheel and marking these with a prick punch. Assuming that the firing order of the motor is 1, 3, 4, 2, the marks on the flywheel will be as follows:

1-4, I-O	inlet valves	1 or 4 open
1-4, I-C	inlet valves	1 or 4 close
1-4, E-O	exhaust valves	1 or 4 open
1-4, E-C	exhaust valves	1 or 4 close
2-3, I-O	inlet valves	2 or 3 open
2-3, I-C	inlet valves	2 or 3 close
2-3, E-O	exhaust valves	2 or 3 open
2-3, E-C	exhaust valves	2 or 3 close

The setting of each valve may be tested by rotating the flywheel in the normal direction until the mark thereon for the inlet valve of the first cylinder registers with that on the cylinder and the balance of the valves check in a similar manner. If the valve mechanism is adjustable, it can be changed to correspond with the marks on the flywheel.

CARE AND REPAIR OF BRAKES.

With large diameter drums and ample face, brakes give maximum efficiency and aside from an occasional adjustment do not cause trouble. There are, however, a large number of converted pleasure cars utilized for commercial purposes and the brakes and linings will require attention from time to time. If the driver is familiar with the principle of brake construction he should be able to make minor repairs as well as adjustments.

Brakes may be divided into two classes, the exter-

nal contracting and internal expanding, although these forms may be applied in a different manner; that is to say, the brake drum may be so constructed as to enclose the contracting band. The principle, however, is similar to the external design.

While it would appear that it is a simple matter to adjust brakes of either type when they do not grip properly, one might so alter the contracting or expanding mechanism that the desired result would be attained, but the brakes would drag. Friction should not exist between the linings and drums because undue wear of the former results, to say nothing of wasted power.

Bands Should Be Clean.

When brakes do not hold it does not necessarily mean that the bands need readjusting. It is possible that the friction surfaces may be covered with oil or grease, a condition that is frequently taken as an indication that new linings are required, especially after the limit in adjustment has been reached. Before assuming that new linings are needed remove the wheels and examine the linings to note if they are impregnated with lubricant. If so, clean them with gasoline and kerosene. It may be possible that the presence of the grease is due to lubricant working out from the differential into the brake drums. Sometimes this is caused by wear of the felt washers, which should be replaced with new members.

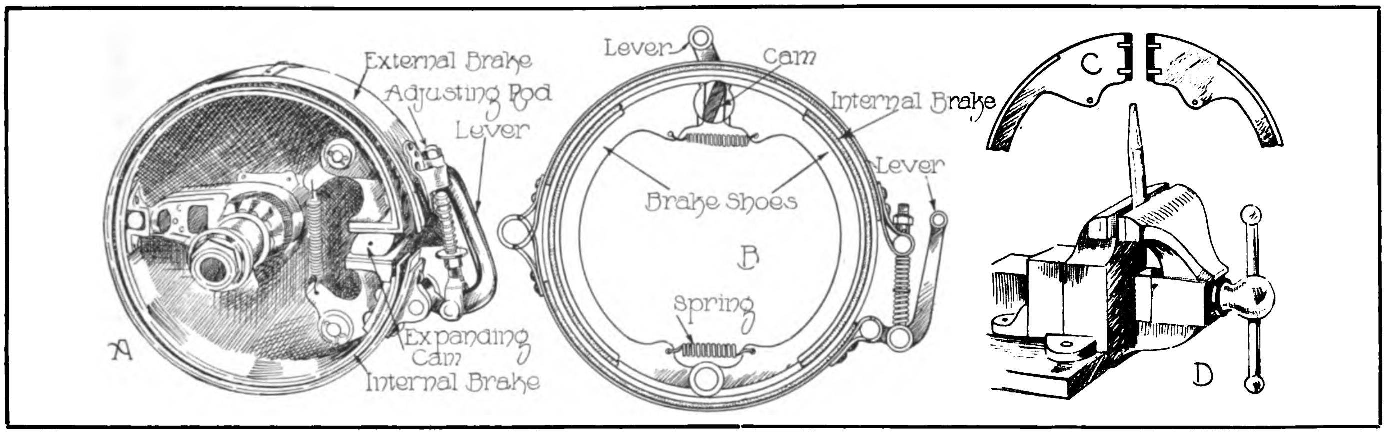
An accompanying illustration shows two types of brakes, that at A being conventional in design. As the components are clearly marked the reader should be able to understand their operation. It will be seen that the outer or external band is of the contracting type, is actuated by a lever and toggle joint arrangement and that means are provided for lengthening or shortening the rod opening and closing the brake proper. By shortening the area of the gripping band is restricted.

Repairing Worn Brakes.

The internal expanding brakes are operated by a double cam and as these are generally employed for the emergency brakes, there is little wear of the expanding mechanism. Where they are utilized for service members, however, the cams will wear in time. When badly worn it may be necessary to fit new parts, but a repair may be effected as outlined at C, this consisting of building up the face members. In making this repair care should be exercised not to increase the normal diameter of the shoe and due allowance should be made for the brake linings, else the brakes will drag and heat.

In relining brakes the first step is to ascertain the original thickness of the lining and the material used. The same width should be employed and the drum measured to obtain the correct length. This is a case of mathematics, or the drum may be measured with a string. Brake linings come in varying thicknesses, ranging from .125 to .25 inch. There are several excellent materials for this work and a list will be found in the Classified Buyers' Guide, elsewhere in this issue.

Removing the shoes is not a difficult operation, but before attempting to displace the rivets securing the lining to the shoes, the latter should be thoroughly washed in gasoline. Some employ a torch to burn off the grease, but the writer prefers the washing process. The shoe is next clamped in the vise and the peined-over rivets cut off with a sharp cold chisel and a hammer. The rivets can then be driven out easily with a punch.



Illustrating Types of Brakes: A, Showing Components of External Contracting and Internal Expanding Design; B, Those Utilized on a Pleasure Vehicle; C, Method of Repairing Worn Faces with Metal Strips Retained by Machine Screws; D, Depicting Use of Punch When Riveting New Linings to Shoes.

Relining Brakes.

Next clean the shoe and secure one end of the new lining to it by clamping the parts in the vise, taking care that the facing is even or flush with the edge of the shoe. In attempting his first relining the novice is apt to fit it unevenly, but by observing caution the band should be free from wrinkles and true.

With the shoe and lining held securely in the vise the drill is run through the rivet hole in the shoe and lining and the latter afterward countersunk so that the head will be well below the contacting surface of the lining when the work is completed. After drilling a number of holes and inserting the copper rivets the shoe is removed from the vise and a punch gripped in the jaws as shown in the drawing. The shoe is then held on the punch so that the head of the rivet is in contact with the top of the punch. The small end of the rivet may then be peined over easily. The rivets should be about as long as the total thickness of the

lining and shoe, which will be plenty long enough, as it must be borne in mind that the lining is countersunk.

In reassembling the brakes all springs should be tested to note if they have the correct tension and are holding the parts properly. When the springs have become stretched or have lost their elasticity the brakes may drag even when properly adjusted. After replacing the wheel and making the final adjustment, rotate the wheels and note if the brakes drag. A simple method is to place the hand on the brake drum after a short run to learn if the drums are unduly warm. If so the adjustments should be altered, as this is a good indication that there is undue friction.

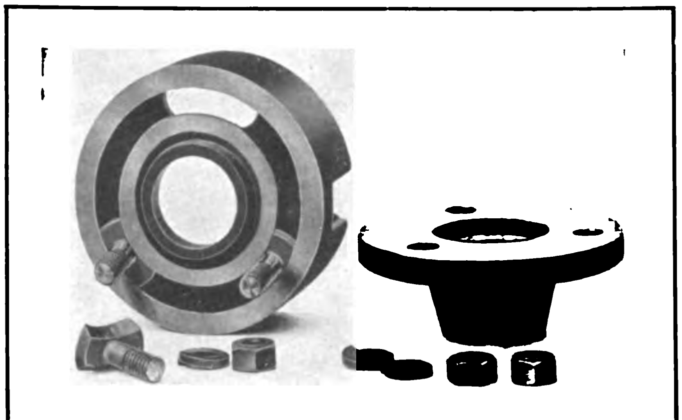


Fig. 1—Showing the Components of Bosch Coupling, Including Cone Member, Flange, Crossbar and Bolts.

As the work of relining the shoes will necessitate the removal of the hub caps, these members should be cleaned and repacked with fresh grease. In locking wheels do not forget to replace all the cotter pins.

BOSCH ADJUSTABLE COUPLING.

Announcement is made by the Bosch Magneto Company, New York City, of a new adjustable flexible coupling adaptable for driving a magneto, pump, etc., where the driving and driven members are out of alignment. The device, which is shown at Fig. 2, has another advantage in that a magneto may be displaced without disturbing the timing or any part of the driving mechanism.

The Bosch coupling comprises a cone shaped piece of steel attached to the armature shaft and terminating in a ring having diametrical fibre lined slots. To the driving shaft is secured a flange that carries a flat crossbar consisting of a large number of fine spring steel leaves or plates. The crossbar fits in the slots or recesses of the cone shaped member, as is shown at Fig. 1.

The laminated crossbar has a marked spring action and permits the two members of the coupling to have a slight relative torsional movement, which is ample to absorb the shock of varying resistance to the rotation of the magneto armature. The spring crossbar also has a slight bending or twisting movement sideways, permitting the two shafts to be slightly out of line. With a rigid coupling the driving and driven shafts must be aligned, and the shock created by the magnetic resistance is transmitted to the driving gears, producing noise. Noisy action is eliminated in the Bosch spring crossbar and ring by lining the cavities with fibre, which in addition, obviates the necessity for lubrication of the working parts.

The cone shaped member of the coupling is made with proper tapers for various types of Bosch magnetos, a recess being provided for the armature nut. This section is keyed to the armature shaft, while the other member of the coupling may be attached to the driving shaft by a key or the bolt which accompanies the coupling.

Where the adjustable flexible coupling differs particularly from the usual flexible coupling is in the construction of the cone shaped member. In the adjustable type this is made in two parts instead of one, the portion engaging the driving member having a circular groove carrying three bolts with tapered heads, as is shown at Fig. 1, which depicts the disassembled coupling.

The portion which is actually secured to the armature shaft is an ordinary flange having three holes in which the taper headed bolts register. When the nuts on these bolts are set up tight there can be no relative motion between the two portions, due to the binding effect of the taper; so that the sections become as one. Upon loosening the nuts, the magneto armature, together with its portion of the coupling, can be rotated through a complete circle.

A vernier engraved on the stationary portion permits accurate regulation to any degree and on this account the magneto may be mounted on the motor without reference to the timing and the armature set in any position after the entire apparatus is fixed. The construction permits of tests being made to secure the best results from timing without changing keyways, cotter pins, etc.; or in other words, the position of the armature may be altered slightly after installing the magneto, a condition not possible with rigid couplings without attention and considerable labor.

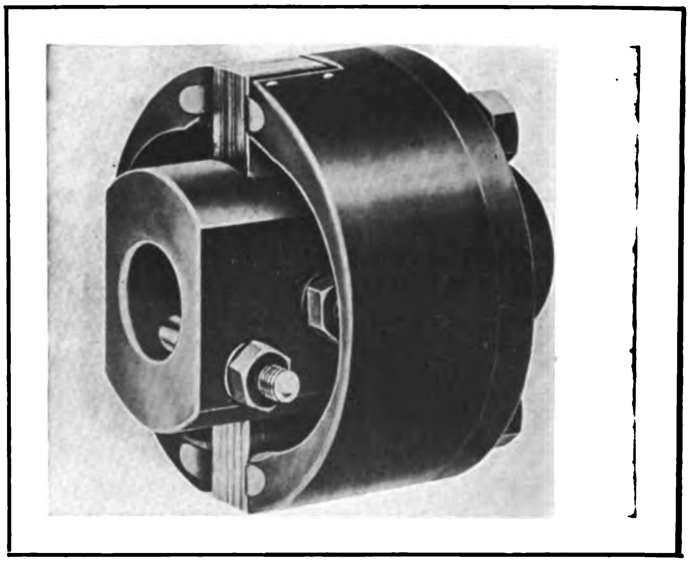


Fig. 2—Bosch Adjustable Flexible Coupling Permitting Driven Unit to Operate Out of Centre or Line, and to Change Timing Without Removing Magneto.

CORRESPONDENCE WITH THE READER.

Timing Splitdorf Magneto.

(29)—Would like information concerning the timing of a Splitdorf magneto and how it may be changed from a right to left hand drive or vice versa. Am installing the magneto on a converted pleasure car which I am using in my business.

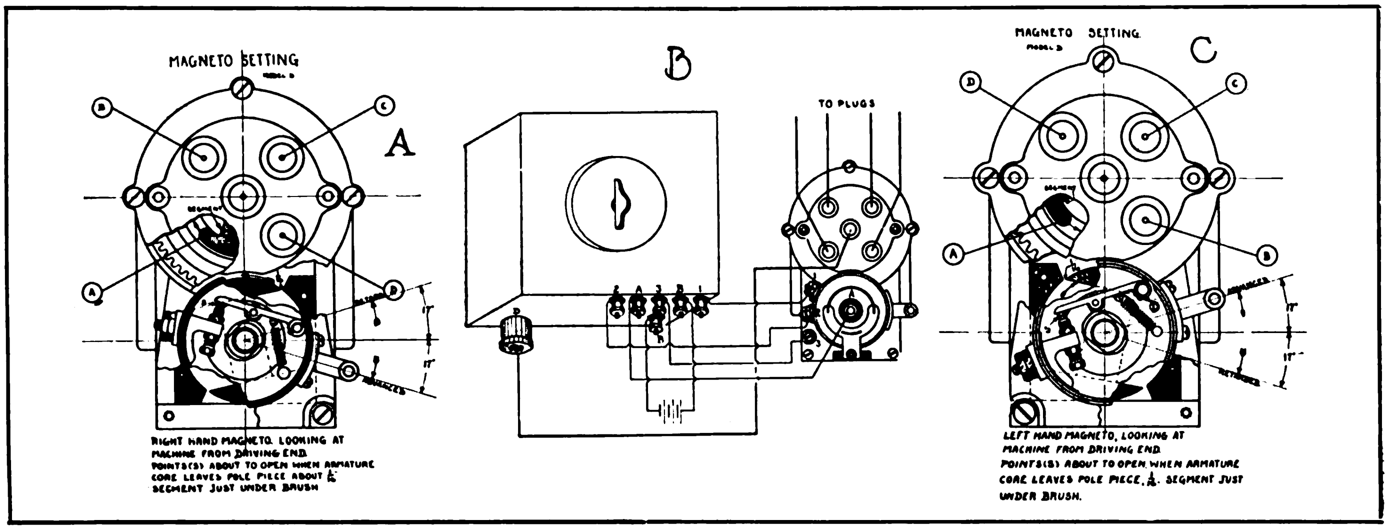
J. B. P.

New Rochelle, N. Y., March 15.

To change from one direction to the other, remove the breaker box, hold the driven end of the armature firmly with a pair of pliers and take off the small retaining or locking nut. Pull off the cam, which is keyed on with a Woodruff key, turn the cam over, replace the nut and reset it on the shaft with a prick punch so that it will not jar loose. Then remove the distributor block and the screws from the lettered ring. Remove the brass projecting cup on the distributor bearings, which will be found inside the inverted U formed by the magnets, and the top screw underneath the centre of the distributor shaft. The distributor and its gear can then be pulled forward out of mesh. Next set the distributor gear so that the position of certained and this must be observed as indicated in the drawing. It should also be borne in mind that the direction of rotation of the armature is opposite to that of the armature shaft, as the distributor is mounted upon a gear which is driven by another gear on the armature shaft.

The direction of rotation is necessary when connecting the high-tension cables from the distributor terminals to the spark plugs. The firing order of the motor must be known, and as all four-cylinder engines fire either 1, 3, 4, 2 or 1, 2, 4, 3, it is an easy matter to watch the intake valves and determine the order of explosions.

Assume that the distributor sector is in contact with the No. 1 cable indicated in the wiring plan at B, and the motor fires 1, 3, 4, 2: Here the distributor is rotating clockwise and as the next explosion occurs in the No. 3 the cup above the first member in the drawing is connected by cable with the third cylinder of



Illustrating the Setting and Timing of Splitdorf Magnetos: A, Diagram for Right Hand Direction; B, Wiring Plan of Vibrating Dash Type of Coil; C, Showing Proper Position of Armature When Driven Left Handed.

the segment will agree with A or C, as shown in the accompanying illustration.

After securing the magneto to its bracket or base on the motor, crank the engine until the piston of the first cylinder, that nearest the radiator, completes the compression stroke and is on dead centre. Next retard the spark advance lever on the steering wheel to its limit and connect the actuating rods, etc., to the spark advance lever on the breaker box of the magneto. If the armature shaft revolves in a clockwise direction looking at the driving end, the lever should be at its topmost position. If the shaft rotates anti-clockwise, the lever should be at the bottom limit and advanced upward.

Next revolve the armature shaft in its direction of rotation until the oval breaker cam comes in contact with the roller in the breaker bar and just begins to separate the platinum contact points. The points should begin to separate when the armature core leaves the pole pieces as shown in the sketch. It is important that the position of the bronze of the distributor be as-the motor. The next contact to be made in rotation is the cup to the left of the last named member, as the fourth cylinder fires next. The second cylinder is the last to be wired to the remaining terminal. It should be borne in mind in making connections that while the distributor sector makes a complete circle the cylinders do not fire in 1, 2, 3, 4 order, but 1, 3, 4, 2. By following the wiring diagram one should not have any difficulty in correctly installing the cables of this system.

The break of the platinum contact points should not be more than .03125 inch and these may be adjusted by loosening a locking nut and setting the screw member. If pitted the points should be trued up with a very fine file, taking care that a good, even contact is secured. In replacing the breaker box cover make sure that it is on properly and snugly, and that the brush member is in contact with the shaft. As will be noted by the wiring plan, both leads from the battery go to the coil and one is not grounded as with the battery and coil system of ignition.

RECENT MOTOR VEHICLE PATENTS

Hancock Throttle Control Device.

Milton T. Hancock, Jr., Los Angeles, Cal., has been granted a patent for a clutch pedal and throttle control for motor cars. It is a combination device in that the throttle opening may be controlled in much the same manner as when the conventional accelerator is fitted. A foot plate is movably mounted on the clutch pedal and is operatively connected to the throttle controlling means. Provision is also made for holding the foot plate in different positions relatively to the pedal and to retain the throttle at different adjustments. The construction is such that when the clutch pedal is disengaged the throttle may be closed automatically to prevent undue racing of the motor.

Holmes Coupling Links for Chains.

A coupling link for anti-skid chains has been patented by Edwin S. Holmes, Jr., Washington, D. C., assignor of one-half to Randolph T. Warwick of the same city. It is designed for connecting the cross chains to the side members and comprises a length of wire bent upon itself to provide a loop having parallel members and the terminal portions are bent to form oppositely disposed hooks with flaring bills. The shank or rear member of each hook projects backward at an angle to the contiguous member of the loop, one member of the latter having a hump at the inner side thereof on a plane with the bills of the hooks and the companion member of the loop having a similar hump toward the connecting portion of the loop. This forms a tortuous passage between the members of the loop.

Dobbins Tire Tool.

The tire repairing tool patented by Timothy C. Dobbins, Los Angeles, Cal., is designed to apply to tires, repairing devices comprising anchor plates adapted to co-operate with a clincher rim. The tool consists of an inserting lever having a gripping jaw adapted to engage on both sides and to support the anchor plate, while forcing the same into holding engagement with the rim. A co-operating holding lever is also included, so constructed as to engage the wheel and a pivoted link connection between the levers makes for alignment when utilizing the tool. A retaining device is secured to the levers to hold them in substantial contact throughout their length when folded together in an inoperative position.

Harper Piston Ring Remover.

In removing rings from the pistons considerable care must be exercised as the former are fragile and are broken easily. Horace G. Harper, Detroit, has been granted a patent for a piston ring remover which presents practical features and the device is simple in construction. It comprises a casing having a fixed stud which engages one end of the ring, and a movable member which engages the opposite end of the ring. These parts are inserted between the slot of the ring and by compressing a handle and ring member the piston ring is opened, permitting of slipping it over the piston. Means are included for holding the ends of the ring and to prevent slipping.

De Clairmont Spark Plug Tester.

A device for testing spark plugs has been patented by Adolfo De Clairmont, Toledo, O. It has spaced electrodes with bushings in connection and a transparent cylinder enclosing the bushings. Means are provided whereby either of the electrodes may be connected directly to a spark plug in a detachable manner, and a handle is secured to one of the electrodes.

Price Valve Lifter.

Charles Price, Clinton, Mass., has patented a valve lifter which differs from those of usual construction in that the valve spring may be held after compression by the tool, permitting of the use of both hands by the operator. It comprises a pair of levers pivoted at one end while the other extremities are provided with suitable jaws for engaging the spring and the valve tappet. The jaws of the lifter are compressed or extended by a loosely mounted screw and the upper part of the lever is provided with means for holding the adjusting screw after the valve spring has been compressed.

Dodwell Resilient Tire.

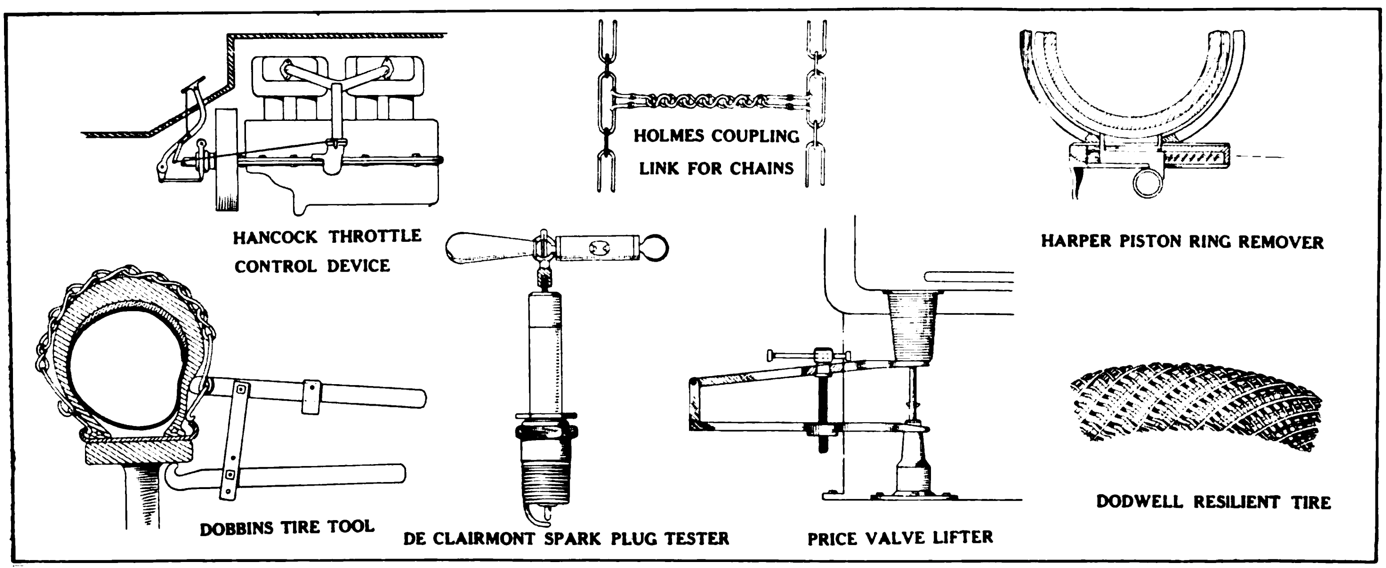
Malby George Crofton Dodwell, Wellington, New Zealand, has been granted a patent for a resilient tire having a plurality of windings, each extending throughout its length. The convolutions of each of the windings are arranged successively with respect to the adjacent members, and a second metallic member extends diagonally of the tire and intersects the convolutions of the windings of the first members. One of these is crimped at its intersections with the other member and has its convolutions lying within said crimp whereby the windings are bound together for the transmission of strains.

OTHER PATENTS GONE TO ISSUE.

Oil Can, Ralph A. Wakefield, Sacramento, Cal. The can is similar to those of conventional construction, but carries a spring actuated pin projecting from the bottom to the top of snout. By compressing the bottom of the oiler the pin is forced away from snout opening, allowing the lubricant to flow. Normally the spring retains the head member upon its seat, closing the aperture.

Fender, Charles G. Wegner, Baltimore, Md., assignor of one-third to Henry F. Sleepack and Amelia C. Wegner of the same city. It comprises a pair of parallel bars having bifurcated portions forming limbs connected to the axle and mudguards and a cross bar interconnecting the limbs, also a flexible covering.

Automobile Horn, Delroy Fifield, Cleveland, O. A horn actuated by the exhaust of the motor and comprising a tube having a partition therein and a valve disc. The latter has spring fingers embracing the partition, and is located at the mouth of the tube. A pipe is employed for conveying the gases toward the side of the disc opposite to the tube.



Illustrating Some of the More Recent Ideas of Inventors of Devices Applicable to the Commercial Vehicle.

TRUCKS MINIMIZE FLOOD SUFFERING.

Food and Necessities Sent to Devastated Western Cities and Towns, and Quick Sanitation Measures, Save Thousands of Lives and Prevent Epidemics of Sickness.

THE world little realizes the extreme necessities resulting from the floods that devastated large areas of Ohio and Indiana, the rescue of people from places of peril, the transporting and distributing of supplies of food, clothing and fuel, and the removal of dead animals and refuse that might become sources of disease and even pestilence. With the railroads generally inoperative, save in sections, from destruction of roadbed and bridges, with telephone and telegraphic communication interrupted, with highways often washed away and seriously obstructed, the really prompt relief given was largely through the use of automobile vehicles. The haulage was by motor wagons and trucks, and driven by willing men these machines were worked almost continuously so long as there was pressing need.

The first attention was given to the collection and distribution of food, and when appeals were made to communities that were more fortunate, and whose people could give, motor trucks were loaded and sent over the roads with instruction to the drivers to go on if progress could be made. The national guard, the life saving crews and the officials of relief organizations followed, and with systematized endeavor the trucks and wagons were even more necessary and the work was extended wherever help was needed.

Dayton, O., the city that suffered the greatest from flood and fire, was the centre that demanded the largest measure of attention, and it was toward this community that the aid of the nation was extended. Food and clothing were the first essentials, then medical supplies, and with the subsiding of the water, sanitation was imperative because of the threatened danger from the accumulated refuse and the bodies of dead animals that were piled in hundreds in the streets and buildings.

The trucks and wagons from outside of the city were absolutely necessary in Dayton, for the larger part of those owned or used by inhabitants were wrecked or disabled by the flood, and some were submerged and could not be reached. Gov. Cox and J. H. Patterson, chairman of the Dayton relief committee, appealed to manufacturers of trucks to send vehicles there to be used in the relief and sanitary work. March 29 a series of telegrams were sent to different concerns and within two hours after receiving a wire General Manager Alvan Macauley of the Packard Motor Car Company had eight trucks on a special train. The following day at noon the machines were at work in the streets of Dayton, manned by expert drivers sent from the factory. The first one off the car carried a score of Red Cross nurses and their baggage to the National Cash Register relief station two miles distant, and the others followed with supplies of food, cots, clothing and medical stores. Following these machines came others sent by other manufacturers, and these were all delivered for service under the direction of the local relief committee.

March 31 the committee began the cleaning of the streets and the 25 Packard trucks of the National Cash Register Company, the eight factory trucks and other machines were used, while some carried supplies from the Fifth street station of the Pennsylvania railroad to the different relief stations about the city. In the sanitary work the trucks were used in pairs, skids and tackle serving to raise the bodies of the dead horses and cows from the streets to the platforms, one machine hauling the carcasses onto the other. The dead animals were taken to a temporary dump about two miles distant. With the trucks 50 carcasses could be moved daily, while with a team and wagon but 10 could be taken away. The trucks, carrying from four to six bodies, made the round trip in an hour. Occasionally the motor trucks were utilized to load the wagons.

Memorial Hall, Dayton, O., Which Was Used as a Relief Station During the Period the City Was Inundated and After the Flood Subsided.

Many of the machines were used for clearing the streets of debris and flood accumulations, others hauled the incoming supplies from the freight yards to the main relief station at the National Cash Register factory, some were used in distributing food and clothing to the different relief stations, and others were utilized

in all kinds of emergency work. In a week the trucks carried away more than 1000 dead animals, removed hundreds of tons of debris from the streets, and distributed the necessaries of life that sustained more than 100,000 people.

Had it not been for the motor trucks that were placed at the disposal of the local relief committee there would have been much greater suffering, and it is probable serious epidemic of sickness would have resulted from the retardation of sanitary work that could not have been accomplished without them. The generosity of the manufacturers in placing at the disposal of the relief committee both vehicles and men cannot be too highly praised, and the services possible by the use of the machines must be regarded as extremely valuable contributions.

What has been stated of Dayton is true, although in a lesser measure, with many of the smaller cities and towns where the relief of the sufferers was accomplished by the endurance of the tireless machines and

Removing the Dead Horses from the Streets of Dayton by Motor Truck, a Work of Great Necessity in the Prevention of Epidemic of Sickness.

unceasing efforts of the willing workers driving them.

Because of the destruction of thousands of horses by the floods, the animals in many instances being drowned in their stables, and the urgent necessity of transportation, there has been a very general demand made for motor vehicles of all kinds, especially those of the lighter types suited for fast delivery. Many manufacturers have been requested by their agents to give especial attention toward supplying this demand, and it is probable that motor vehicles will replace a good proportion of the animals. In one instance an agent made a call on a builder to have sent to him 50 light machines, there being so few animals remaining and the needs of the community so urgent. While this condition does not apply to all of the flooded areas, it may be said that the business men who have resources and require delivery or haulage service will seriously consider the utility of the motor vehicle, and it is probable there will be a very large increase in the use of machines as a result of the floods.

TO PRODUCE ENGINE PARTS.

New Concern Organized in Detroit Under Management of C. A. Goodspeed.

The Goodspeed-Detroit Manufacturing Company, Ltd., of Detroit, is a new company organized to build a factory to cost $20,000 on a $4000 site, in which will be made automobile engine parts. The concern has a paid in capital of $30,000, and the active head of the firm is C. A. Goodspeed, who is secretary, treasurer and general manager.

He was formerly connected with the Packard and Studebaker companies of Detroit, makers of high grade pleasure cars and trucks of the same names. The site of the new factory is on Harper avenue, opposite the plant of the Regal Motor Car Company, maker of Regal cars. The building will be two stories high and will afford a large floor area.

NEW ROTARY VALVE MOTOR.

Company to Be Organized to Produce Engine Designed by C. W. Sponsel.

C. W. Sponsel, formerly superintendent of the General Electric Company's plant at Pittsfield, Mass., is forming a company to be capitalized at $250,000, to manufacture the Sponsel rotary valve motor. Mr. Sponsel is working at present at Racine, Wis., but it is understood that Detroit capitalists are endeavoring to have the company locate in that city.

Mr. Sponsel has worked upon his invention for many years and his first patents were secured in 1903. It is stated that a balanced valve, eliminating about 150 parts found in a poppet valve motor, forms the principle of the new engine. A model is now being made in Detroit.

GARFORD TO HEAD CONCERN.

Well Known Truck Manufacturer Interested in Production of Aluminum Goods.

A. L. Garford of Elyria, O., formerly president of the Garford company of the same city, maker of Garford pleasure cars and trucks, is at the head of a new company recently incorporated with a capitalization of $100,000. With Mr. Garford in the venture are Walter F. Brown, chairman of the Ohio Progressive state committee, and Attorneys Sigmund Sanger and E. C. Froelich of Toledo.

The new concern is known as the Garford Engineering Company and it will probably locate its plant in Toledo. Its purpose is to develop a new process of producing aluminum with the strength of steel in all forms. Mr. Garford sold his control of the Garford company about two years ago to the Willys-Overland Company, but is understood to have retained a financial interest in the Elyria plant.

MORE THAN 50,000 SERVICE WAGONS BUILT.

INFORMATION received by the National Association of Automobile Manufacturers in response to requests sent to the 312 different listed concerns or individuals building service vehicles during February and March of this year, and collated as the second census of the motor vehicle industry, has been sent out in the form of a statistical report to the trade. It is decidedly interesting and, when compared with the figures of the first report made by the association a year ago, shows a remarkable development of the industry.

The facts contained in the report are of unusual interest. The comparison is made on the basis of reported production prior to 1911, and the number of vehicles produced during 1911 and 1912. This permits the use of three series of figures of assumedly known data, and to these are added the estimated output for 1913.

The requests for information sent to 280 gasoline and 32 electric vehicle manufacturers elicited 170 replies that were sufficiently definite to be included in the detailed report. About 40 per cent. of the firms or persons listed as manufacturers made no reply whatever, which apparently justifies the conclusion that they are not active or important. It may be that some are engaged in development or experimental work, while others may have produced vehicles in such small numbers that it was believed best to make no report, rather than have the reputation of building a few machines only.

The reports received from the 170 companies include 140 that make gasoline motor vehicles, 20 that build electric machines, one steam vehicle builder and seven makers of fire apparatus. Included in the electric classification are also the gasoline-electric machines.

In the statement relative to the production prior to 1911, 25 per cent. of the total reported has been added to provide for machines of which no record is available. To the figures for 1911 and 1912, 10 per cent. has been added to make up for any number not provided for in the reports. The estimate for the year 1913 is based on statements of anticipated production by manufacturers, and it may vary widely from the total given as the probable production.

The actual number of machines reported built prior to 1911 was 10,374, and during 1911 10,655 vehicles were produced, or a total for the industry of 21,029 up to 1912. During the year just past 21,929 wagons and trucks were turned out, this making a reported total to 1913 of 42,968. In the statement, however, 25 per cent. is added to the production prior to 1911, or 2594, which brings the total to 12,968 for that period; the same percentage added to the 1911 production adds 2664 and brings the total to 13,319, and with 10 per cent. added to the 1912 output, or 2194, the total is 24,133. The grand total of the industry until 1913 is given as 50,420 vehicles. The statement may be thus made:

Production Reported.			
To 1911	10,374		
1911	10,655		
1912	21,939		
		42,968	
Added for Discrepancies.			
To 1911, 25%	2,594		
1911, 25%	2,664		
1912, 10%	2,194		
		7,452	50,420

According to the reports received the estimated production for 1913 is 51,586, and to this is also added 10 per cent. to cover production not included in the reports, which makes the total estimated production 56,744. The valuation of the machines is given on the basis of the production reported, as follows:

To 1911	$20,485,231
1911	22,292,321
1912	42,942,828

It is estimated that the value of the production anticipated for 1913 will be $98,288,872.

The statement is made that aside from 12 to 15 companies, those that did not make report are comparatively new concerns that produced few or no machines during 1912, and the older or better established firms did not in any case build more than 50 vehicles.

It will be noted, however, that this statement applies to reported production, and it does not include a considerable number of converted pleasure vehicles, nor does it consider the number that have been built by individuals or concerns that could not be considered as manufacturers. So far as the added percentage for absence of reports, etc., it will be understood that this is apparently very large, but if this proportion will include the converted machines it will probably be very close to the actual figures of industrial vehicles in service today. The registration figures published by the MOTOR TRUCK last January, which ranged in date from Nov. 25 to Dec. 12, 1912, was the basis of an estimate of approximately 50,000 service wagons in use in the United States, and this was considered to be conservative and more accurate than anything previously published. This coincides closely with the report of National Association of Automobile Manufacturers.

The report sent out is interesting from the deductions made. According to the information supplied by 170 companies the machines built in 1912 were in number and in value as follows, in some instances the valuation being estimated:

Gasoline vehicles	20,052	$37,474,308
Gasoline vehicles	100	162,357*
Fire apparatus	140	843,900
Fire apparatus	135	813,760*
Gasoline tricars	58	23,610
Gasoline tractors	42	122,500
Electric vehicles	1,351	3,330,568
Mixed systems	59	163,800
Steam vehicles	2	8,025
Total	21,939	$42,942,828

*Production reported with no statement of value; estimate made on average price of other vehicles of the same character and capacity.

The estimated production for 1913 shows the following:

Gasoline vehicles	44,245	$83,073,200
Gasoline vehicles	1,775	2,620,847
Fire apparatus	232	1,422,250
Fire apparatus	260	1,595,200
Gasoline tricars	1,500	662,500
Gasoline tractors	800	2,125,000
Electric vehicles	2,736	6,627,750
Mixed systems	25	108,125
Steam vehicles	13	54,000
Total	51,586	$98,288,872

A comparison of the production of service vehicles is made that is based on the reports of 85 companies for the period previous to and during 1911, and for 117 companies for 1912, as well as for the estimate for 1913, with reference to number of gasoline and electric machines. This is:

	Reported by 85 companies		Reported by 117 companies	
	Sold prior to 1911	Sold in 1911	Made in 1912	Production for 1913
Gasoline	10,230	10,451	20,528	48,867
Electric	144	204	1,351	2,736
Total	10,374	10,655	21,879	51,603

Considering these for a moment it will be seen that the reports of the 85 companies are the basis for the figures of 1911 and the period previous to that time, with the addition of the 25 per cent.; that the figures of 117 companies practically are the basis of the estimates for 1913 as well as the production for 1912. There is a discrepancy in this statement of 60 vehicles as compared with the first tabulation of production, and of 17 in the number of vehicles shown in the third tabulation. While there is no doubt definite information lacking with reference to production in many instances, and the discrepancies are due to this fact, the statement relative to electric vehicles is insufficient, for it is certain that one concern alone in 1913 has built about 2700 machines, which is 1000 more than is credited as production to that time, to say nothing of the output of a number of other concerns that have produced vehicles for years in considerable numbers. The total number of electric service machines in use in the United States is uncertain, but more than a year ago a statement was made by the Electric Vehicle Association of America that 58 firms alone were using 2292 wagons and trucks, which is 600 more than the accredited production to 1913, and it is extremely probable that the aggregate of the vehicles in use is at least double the number given in the report.

The statement is made that the makers of gasoline vehicles have frequently changed models, this being demonstrated by the concerns making full report for 1912 and making estimate for 1913, where 35 types have been discontinued and 44 new models added, while during the same period 12 electric models were discontinued and five begun. With the gasoline vehicles these changes are most noticeable with machines of 2500, 3000, 5000, 6000, 7000 and 12,000 pounds, and with those of 1500, 2000, 3000 and 7000 pounds capacity in the electrics. In manufacturing the capacities of vehicles produced in largest numbers are the 1000, 1500, 3000, 4000, 6000 and 10,000 for gasoline machines, and the 1000, 2000, 4000 and 7000 sizes in the electrics.

According to the report the average price of all vehicles built in 1912 was $1957.37, that of the gasoline machines being $1868.95 and of the electrics $2465.18. The average price for 1911 for the gasoline vehicles was $2079.16 and $2759.66 for electric wagons, and the average price for the period prior to 1911 was respectively $1955.70 and $3369.72. In comparison of prices it is found that the average prices of the 1500, 3000, 4000, 8000 and 10,000-pound gasoline machines have decreased materially during the period of years, and the prices of the 2000 and 6000 sizes have increased, while with the electric vehicles the average prices of the 1000, 2000, 4000, 8000 and 10,000 sizes have been reduced, and the prices of the 1500, 3000, 7000 and 11,000-pound sizes have increased. For 1913, basing the estimate on the prices reported, the average cost of the gasoline vehicles will be $1877.57, and of the electrics $2422.44.

EXPERIMENTAL STREET PAVING.

Tests to Determine the Surfacing Most Enduring Under Traffic Proposed for New York.

Because of the agitation by some New York legislators who are interested in the enactment of a proposed bill in the general assembly of that state, and who base the claim that service wagons should be taxed at $5 a ton capacity on the contention that they are destructive of the streets and highways, men identified with the motor vehicle trade are devoting their energies toward controverting these arguments and the general public impression that might be made.

Morris R. Machol, general manager of the Hydraulic Truck Sales Company, New York City, believes that to determine the class of road that will best meet the traffic conditions, and to ascertain what particular class of traffic does the most damage to the roads, it would be well to lay experimental paving where the traffic would supply the differing conditions and closely observe the results. He maintains that the wear of a road surface is entirely dependent upon the weight a square inch upon it, and that it is in every way practical to regulate this weight by the proportions of the tires. That is, the width of the tire should be proportionate to the load upon it, and with reference to the diameter of the wheel and the speed of the vehicle. He suggests that the experiments with paving could be made by automobile engineers and road builders jointly with a view of learning what changes might be desirable, if any, in vehicles and road construction methods.

The General Motors Truck Company announces that Assistant Sales Manager E. J. Kilborn has been made general manager of the Chicago district of the company's organization, and that Otto Stoll, manager of the St. Louis branch of the company, has been appointed assistant sales manager.

BRIEF NEWS OF MANUFACTURER AND THE TRADE

The development of the plant of the General Vehicle Company at Long Island City, L. I., which has been progressing since last autumn, and which will be completed during the present year, will involve an expenditure of nearly $1,000,000 in new buildings and equipment. The demands upon the manufacturing department which were considerably in excess of the facilities a year ago, and the acquisition of the American rights to manufacture the Mercedes gasoline trucks, compelled a very large increase of the manufacturing plant. The original building is a two-story brick structure 100 by 520 feet, having a floor area of about 105,000 square feet, in which until the completion of the new buildings the general offices and the production departments will be located. Contiguous to this a structure 75 by 500 feet, six stories, is now being erected, and this is to be one of the finest in the world. It has a steel frame and is of concrete faced with red brick. It has as a foundation 1206 concrete piles of an average length of 32 feet. The purpose is to devote the five lower stories to the production of electric vehicles, and the sixth floor to the general offices. In this will be four elevators, two for passengers and two for vehicles. The building will cost, without tools, at least $500,000. When this structure is ready for occupancy the electrical division will be moved to it, and the present building will be remodelled and will be a machine shop and assembly room for the Mercedes truck division. The third building, which is yet to be built, will be of brick and concrete, one story, 50 by 240 feet, and this will also be given over to gasoline truck production. The machine equipment of the buildings will be in every way complete and every labor saving and economical tool will be utilized. When the plans were originally made it was expected to rapidly complete the buildings, but numerous delays have been experienced, including engineering problems and uncertainty of street changes, which would affect the large real estate holdings of the company.

The Kissel Motor Car Company, Hartford, Wis., maker of KisselKar trucks and pleasure cars, has appointed the following distributors: Brooks Auto Company, Turlock, Cal.; F. H. Davis, Placerville, Cal.; Geyer & Boroski, Colusa, Cal.; J. S. Gill, Pleasanton, Cal.; W. W. Head, Chico, Cal.; W. J. Booth, Lebanon, Ore.; C. R. Canfield, Willamina, Ore.; John Gray, Roseberg, Ore.; E. E. Leas, Oakland, Ore.; W. J. Benbenick, Bremerton, Wash.; G. A. Thomas, White Salmon, Wash.; B. N. House, Cle Eluni, Wash.; McGhee Auto Company, Kent, Wash.; Hugo A. Gutenkunst, Owen Sound, Ont.; Morrin-Thompson Company, Phoenix, B. C.; J. F. Austin, Monterey, Mexico; C. R. Miller, Stockholm, Sweden; Saskatchewan Garage, Moose Jaw, Saskatchewan; B. E. Munson, Crow's Landing, Cal; E. T. Neal, Paso Robles, Cal.; F. O. Taylor, Ukiah, Cal.; Wisnom-Bonner Hardware Company; San Mateo, Cal.; F. M. Wyatt, Winters, Cal.; Western Auto Supply Company, Reno, Nev.; Elko Auto Company, Elko, Nev.; McCoy & Veazie, St. Helena, Ore.; S. A. Mills, New Berg, Ore.; Newmith Auto Company, Salem, Ore.; A. Wilhelm & Sons, Monroe, Ore.; J. J. Wirtz, Forest Grove, Ore.; Ernest Peterson, Mt. Vernon, Wash.; M. M. Stewart, Aberdeen, Wash.; Twin City Auto Company, Chehalis, Wash.; Yakima Auto & Supply Company, North Yakima, Wash.; Knueppel & Ott, Davenport, Ia.; Barre KisselKar Company, Barre, Vt.; Johnson & Stevens, Booneville, Mo.; Hodge's Garage, Greenpoint, N. Y.; Edward J. Deasy, Glen Cove, N. Y.; Hackensack Auto Service, Hackensack, N. J.; O. R. Hukle & Co., Lexington, Ky.; Chandler & Hightower, Ft. Worth, Tex.; Boulevard Garage, Bridgeport, Conn.; Taximeter Auto Company, Paterson, N. J.; W. A. Platt, Mountain View, Cal.

The Summit Auto Company, Akron, O., has been incorporated, with a capital of $10,000 to deal in trucks and pleasure cars, by E. J. Eblen, J. M. Lauder, F. L. Matz, Rachel Lauder and Almira Eblen.

The Available Truck Company, Chicago, has moved to a larger factory in which its capacity will be doubled. New machinery has been installed. The officers of the concern are: President and general manager, John Rath; secretary and sales manager, E. F. King; treasurer, R. C. Blume.

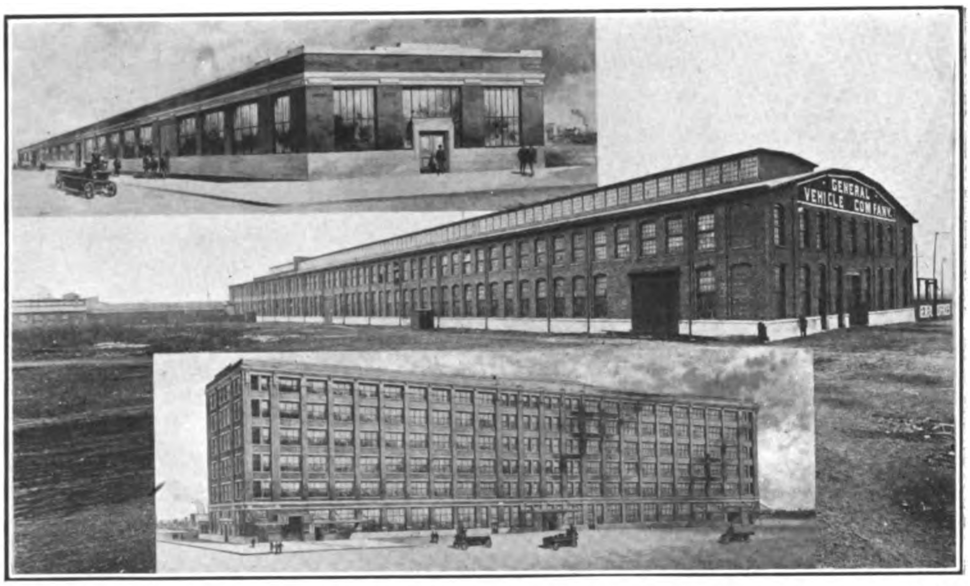
The Manufacturers' Association, Chattanooga, Tenn., is negotiating for the establishment of a motor truck factory in that city. The company will be capitalized at $100,000.

The Four-Wheel Drive Auto Company, Clintonville, Wis., maker of Four-Wheel Drive trucks, has increased its capital from $50,000 to $250,000. The additional stock has been sold and extensive additions will be built to the factory. The plans call for three buildings and 500 men will be employed when they are ready for occupancy.

The F. L. Moore Motor Truck Company and the Pacific Metal Products Company, San Francisco, Cal., have consolidated under the name of the latter concern. The capital stock is $1,250,000 and plans are being made for a large truck factory at Torrance, Cal.

The Kardell Motor Car Company recently took over the business of the Chase Motor Truck Company of St. Louis, Mo., and will handle the Chase line, made by the Chase Motor Truck Company, Syracuse, N. Y.

George H. Albertson, formerly president of the Duquesne Sanitary Company, Pittsburg, Penn., and his son, Wilbert Albertson, have opened an establishment at 429 Liberty avenue, that city, known as the Vulcan Service Motor Truck Company. The concern handles the Vulcan service truck, made by the Driggs-Seabury Ordnance Corporation, Sharon, Penn., and the Service motor truck, made by the Service Motor Truck Company, Wabash, Ind.



General Vehicle Company's Plant at Long Island City, L. I., and the Buildings Now Being Erected: In the Centre, the Present Building; Above It the New Structure for the Gasoline Truck Department and Below It the Building to Be Occupied by the Electrical Division.

H. P. Barnstetter has been appointed assistant sales manager of the Chicago branch of the Kissel Motor Car Company, Hartford, Wis., maker of KisselKar trucks and pleasure cars.

L. H. Wessels has been appointed Philadelphia branch manager of the Chase Motor Truck Company, maker of Chase trucks, at Syracuse, N. Y.

The Standard Roller Bearing Company has opened a branch office in the State Life building, Indianapolis, Ind., in charge of L. M. Watkin, Jr.

C. Robert Hoyme, prominent in the automobile business of Philadelphia for the past seven years, has been appointed manager of sales and service of Alco trucks, made by the American Locomotive Company, New York City. Mr. Hoyme previously was sales manager of the International Motor Company

branches at Philadelphia, Baltimore and Washington, and before that he was associated with the Autocar Company.

The Standard Welding Company, Cleveland, O., maker of Stanweld rims, seamless steel tube and other products, announces the resignation of R. M. Hawkins, formerly assistant purchasing agent.

Harry C. Tillotson, formerly a director and treasurer of the McDuffy Automobile Company, is now a director and secretary of the Stromberg Motor Devices Company, maker of Stromberg carburetors and motor accessories. In addition to the active duties of secretary he will have personal supervision of the sales.

Dwight Holmes of 1231 South Flower street, Los Angeles, Cal., has taken the distributing rights for his territory for Speedwell pleasure cars and trucks, made by the Speedwell Motor Car Company, Dayton, O. His son, G. S. Holmes, will operate the agency for the same line at 121 South State street, Salt Lake City, Utah.

C. E. Martling of New York City recently succeeded H. P. Childs as local branch manager of the International Motor Company, in that city, the latter being promoted to become assistant eastern sales agent.

E. A. Stone has been appointed manager of the new factory sales branch in Indianapolis, Ind., of the Republic Rubber Company, Youngstown, O.

The Studebaker Corporation, Detroit, maker of Studebaker trucks and pleasure cars, preparatory to the spring and summer business, located its branches in new homes in the following cities: St. Louis, Mo.; Atlanta, Ga.; Omaha, Neb.; Minneapolis, Minn.; Salt Lake City, Utah, and Washington, D. C.

W. T. Norton of the Selden Motor Vehicle Company, Rochester, N. Y., maker of Selden trucks, has been promoted to the position of general factory superintendent and will have complete charge of the production of both passenger cars and trucks.

William D. Paine, formerly with the United States Motor Company, Philadelphia, Penn., and recently with the Studebaker Company of that city, has joined the forces of the E. V. Stratton Company, Albany, N. Y., as representative in the Troy district of Stewart and Hudson commercial vehicles.

W. H. Wood has been appointed manager of the commercial vehicle department of the Waverley Company, Indianapolis, Ind., succeeding A. L. Dixon, resigned. Mr. Wood was formerly connected with the Westinghouse Company, Pittsburg, Penn.

The Brooks-Norton Motor Sales Company, Cleveland, O., has moved into new quarters at 2169 East Ninth street. The company handles Schacht and Modern trucks.

The E. V. Stratton Company, Albany, N. Y., distributor for Stewart trucks for eastern New York and western Massachusetts and Vermont, has leased for a term of years the premises now occupied by C. S. Ransom on Chapel street, opposite the Hotel Ten Eyck. The building will be refinished inside and out, with stock and supply department and offices fitted up at the rear, and an attractive show room at the front.

F. N. Schwab has taken the position as manager of the Chicago branch of the Speedwell Motor Car Company, Dayton, O., maker of Speedwell cars and trucks.

Arthur G. Kerrigan, for many years with the Autocar Company's branch at Boston, has resigned to join the sales force of the R. & L. Company, eastern distributor of Garford trucks and pleasure cars, at 915-921 Boylston street.

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., MAY, 1913 No. 5

HARDEST WORKED TRUCKS IN AMERICA.

Fleet of 67 Garford Machines in Service of the New York Mail Company, Used Practically Night and Day and Often Exceeding 100 Miles Daily, Yields Surprising Economy.

By William W. Scott.

WHAT can be regarded as the hardest worked fleet of motor vehicles in America, and there are some installations that have exceedingly hard service, is that used by the New York Mail Company, which has the contract for the haulage of mail in New York City, south of Forty-second street. The only other that parallels it is the installation of the Motor Service Company, which has a similar contract north of Forty-second street. The vehicles of the New York Mail Company are of one make, the Garford two and three-ton gasoline wagons and trucks, and in this it is also paralleled by the Motor Service Company, which has a complete electric equipment—all General Vehicle machines.

But the work that the New York Mail Company is contractor for is decidedly larger than the other, and it keeps the 67 machines at work practically every minute. It is extremely important, for the New York postoffice handles daily a far greater volume of mail than any other similar branch of the government service. There are many reasons for the enormous importance of the New York mail to the nation and the world. New York is the commercial centre of America, and it is second only to London in international commerce. The mail is the logical and generally accepted method for transacting business. Eliminate the mail and commerce and industry the world over would be paralyzed. As an illustration of the value placed upon time in the delivery of mail, one of the most forceful arguments made to attract tenants to the new Woolworth building in New York is its proximity to the general postoffice, where the mail is delivered earlier than delivery can be made in structures further away, an economy estimated to be 15 to 20 minutes in time with reference to any given round by the carriers.

Three-Ton Garford Truck and Standard Straight Side Postal Service Body Used by the New York Mail Company.

The New York Mail Company's present contract will expire at midnight, May 31, and it is probable that before that time another contract will be made by the postoffice department. The existing contract was for a period of four years and it was entered into June 1, 1909, the bids having been made on a basis of horse service. This contract provides for the transfer of the mail between the general postoffice and the branch postoffices of the borough of Manhattan south of Forty-second street, and between the postoffice and the branch postoffices and the railroad terminals, and the haulage of the incoming European mail to the postoffice, its branches and the railroad terminals.

The New York Mail Company succeeded itself as

contractor for the work. The haulage of the mail in a city of large proportions is a work that cannot be taken over by a contractor, as might be practical or possible with other work. Mail transportation is a business that requires the greatest care and intimate knowledge of conditions, and it has been customary with a contractor taking a new contract to take over the equipment and employees of the predecessor, because it would not be possible to conform to the requirements of the contract without a well trained and efficient organization. For this reason, while contractors may change, the mail service goes on without interruption.

The New York postoffice is the most important of the postal system of the United States. From this is distributed many hundreds of tons each day, and a volume that is correspondingly large is received. New York is the largest publishing centre of America. The publications, newspapers, periodicals, books, etc., to say nothing of the advertising and trade promotion literature, are distributed through the mail. The letters sent out daily number millions. It must not be understood that the contractor that is the subject of this article had to do with all of the postal service of New York, because the Motor Service Company has the contract for the northern section of Manhattan and the Bronx, and other contractors have the work in the other boroughs that include Brooklyn and Staten Island. In addition to this all the outgoing European mails are transported from the general postoffice to the different steamship lines by the steamship companies, and the collection of the mail from the mail boxes and the sub-stations is done by other contractors.

Two-Ton Friction Driven Garford Wagon, Equipped with Standard Covered Express Body with Flared Sides.

It is difficult to estimate the number of men and vehicles actually engaged in handling the mail received and dispatched from New York, but there are several thousand employees and several hundred vehicles. Besides all this there are numerous mailing companies, which prepare mail for delivery to the postoffice, and in some instances these deliveries are made to the postoffices or are sent to the railroad terminals under the supervision of clerks of the postal service. Besides this, some of the large concerns doing mail order business deliver their own mail to the railroad stations practically made up and pouched, and one of these sends a three-ton truck of mail to the Pennsylvania railroad terminal each half hour of the day from 8:30 in the morning until 6:30 or later at night.

Since the inauguration of the parcel post, Jan. 1, the work of the postoffice has been greatly increased. The New York Mail Company in its contract area handles more than 30,000 packages each day, and this number has been growing so rapidly that it is difficult to keep pace with the requirements. The small packages are pouched, but the larger parcels are handled without pouching. The bulk of the packages is one of the conditions that cannot be anticipated and of course in handling these varying requirements must be met as they become known.

With relation to the incoming European mail: This is all made up on the steamers and no less than six reports are received, the first from Cape Race and ending with one at Quarantine, where the mail is transferred to the postal lighters. In transferring the pouches there is a lighter at either side of the ship and as the mail sacks are brought up in large nets it is divided on the deck and that for the city goes to one lighter and that for other destinations to the other. The number of sacks is reported to the contractor and wagons are dispatched to Pier 13 for the city mail and to Pier 83 for the other. The city pouches are taken to the general postoffice, and the outside mail is taken to whatever railroad terminal it is dispatched over.

It is not possible to anticipate the arrival of European mail with sufficient accuracy to have it regularly scheduled, and the volume varies materially, but it is not unusual to have as many as five steamers arrive in a single day, and sometimes there will be intervals of several days between arrivals. It will be seen that the requirements fluctuate decidedly, for occasionally there are several thousand pouches in a single arrival. When mail is received it is necessary to transport it without delay, and this must be done in addition to the work of the domestic postal department.

The contract for mail transportation is always begun at midnight and continues for a definite period. The service is specified by the department, and this is usually on the basis of a certain volume to be hauled between stated points. This is to be hauled at stated trips, the time of departure from an initial point and the time of arrival and departure at the intermediate points, and the time of arrival at the objective point all being fixed. This may be applied to any number of

trips between the general postoffice and the branches and the railroad terminals, and when the work has been thus specified it is necessary for the contractor to determine how he can meet the requirements with the fewest number of vehicles. A specified price is paid for the stated service, and if it is possible to so arrange the haulage that a lesser number will do the work the postal department is satisfied. As a business proposition it is necessary for the contractor to so systematize his service that he can do it with the least possible number of men and vehicles.

It is necessary in making out the schedule for each work to have each vehicle leave and arrive on time, and in no instance is a wagon permitted to arrive or depart ahead of the time fixed, save at the final or objective point, which may be reached ahead of the time set. What is regarded as a reasonable time is allowed between points, and no matter what the circumstances, unless it is entirely beyond the control of the contractor, there is no excuse. This schedule must be maintained under all conditions, winter or summer, the only provision made for extremes of snow or sleet or fog being that when the snow is very deep a "headway" is established, which means stated intervals between trips for the period the adverse conditions obtains, and when the fog obstructs the North river and prevents the trips of the ferries with regularity the wagons are dispatched with a larger margin of time to make deliveries at the railroad terminals in Jersey City, for the contract calls for haulage to the railroads in that city.

The New York Mail Company had 520 horses in its service when the present contract was made and sufficient wagons, single and for two-horse teams, to meet the requirements. After 18 months the first motor wagons were installed. The first installation numbered 16, and the big stable at 531 East Fifteenth street was used in part as a garage. This is a five-story structure and in it at that time was a blacksmith shop, wheelwright shop, harness shop, paint shop, and the company did all its necessary work for the maintenance of the wagons and harness and the shoeing of the horses. Besides this it had another stable in East Twentieth street, where a considerable number of horses were kept.

After the first use of motor wagons the horses were gradually disposed of until about a year ago the entire service was motorized, there being now in use 67 Garford wagons and trucks, 27 of two tons capacity, these being of the friction drive type, and 40 of three tons capacity, these being of the conventional chain drive with a three-speed ratio and reverse gearset in the power transmission. These are all equipped with covered express bodies, with screen sides and rear doors, which are loaded from the rear. The two-ton wagons have an extension hood built with the body, but the others have cabs for the driver, behind which the bodies are installed. The wagons are all built with the motors under floorboards.

The company has 240 employees in its organization, there being two drivers for each vehicle and a sufficient number of drivers to provide for emergencies, accidents and the like. Each man has what is known as a "tour," which calls for 12 hours' work, and each machine is expected to cover an average of 48 miles to a tour, so that under normal conditions each machine in service will make 96 miles daily. But as a matter of fact some of them make much more than that mileage. Extra trips must be provided for and these are the result of an excess of mail. The additional vehicles are provided at notice being given, the company having an hour in which to supply what number may be required to relieve any particular route. For this extra service the company is paid a stated price a trip. The wagons are all dispatched by a dispatcher at 531 East Fifteenth street, but there are additional dispatchers at the general postoffice, and the Grand Central and the Pennsylvania railroad terminals.

No Delays Are Permitted and the Garage Repairers Work on the Trucks in the Street Unless the Job Is of Considerable Proportions.

The wagons are generally brought to the garage for an exchange of drivers, to have repairs, etc., but the company also has garages at 9 Ninth avenue and 530 East Twentieth street, and it is not infrequent that a machine will be sent out and placed on a route where it will not return to the East Fifteenth street garage for a week or more, being kept at work day and night so long as it is operative. This means that in some instances a truck will be worked 96 or more miles each day for seven or more consecutive days, and the aggregate mileage for a month is exceedingly high.

The machines are inspected as often as they reach the main garage and of course they are sent there

whenever attention of any kind is needed, but the intention is to have all the work that can be done performed during the day. The garage equipment includes a shop with all the necessary machine and hand tools and a complete stock of parts of all kinds, and a force of men experienced with the machines. The time of each vehicle is a large asset with the company and this has been accentuated by the expiration of the contract June 1, and the company has endeavored to do the work with the machines it has, not desiring to spend money for additional equipment until after the award of the new contract.

So far as possible the machines are not withdrawn from service. When it is possible to do so the work on them is done in the street, and because of the demands the vehicles are not even painted. The wagons and trucks are washed and the mechanism is given careful attention, but aside from this nothing will be done until the expiration of the contract, simply because of the inability to spare one for any length of time. As an illustration of the work that is done by the machines it may be stated that the postal department Jan. 1 last advertised for bids for the work, specifying that the contractor should have 40 3000-pound and 20 1500-pound wagons, but with the additional demands for transportation through the parcel post and the probable increase during the period covered by the contract, the specifications were withdrawn and bids were invited which specified the services of 80 three-ton trucks and 20 1500-pound wagons. The increase of capacity can be realized when it is known that the aggregate capacity for which bids were first asked was 75 tons, and the bids are now open for vehicles having a capacity of 270 tons. As each machine will be expected to haul many tons a day this will give some idea of the magnitude of the contract.

With the machines now in use it would not be possible to do the work were it not for the fact that they have the right of way through traffic and cannot be unnecessarily delayed, and that a large part of the work is done during the night, when the streets are comparatively free. The haulage is very heavy during the nights until 3 in the morning, for there are the mails for all the night trains to be transported, as well as the flood of newspapers. The newspapers alone make a good part of the mail, there being trains made up that run to Chicago and St. Louis that carry nothing else, as well as the heavy newspaper mail to practically every point in the country. Between 3 and 6 in the morning is probably the lightest part of the day. A good deal of mail is sent to the Grand Central station from the general postoffice by pneumatic tube, but when the tube service fails the company is required to transport the pouches that would be sent by other means.

The company has an emergency crew and wagons at the East Fifteenth street garage that is constantly on call. Should a loaded wagon, and they are loaded practically all of the time, be disabled, the emergency crew starts carrying whatever may be necessary to meet the requirements. If it is possible to do so the disabled machine is towed to its destination, for it requires time to make a transfer of the mail, and it cannot be done except under the supervision of a clerk, who must be sent for. If a wheel is broken, or the damage is such that a transfer must be made, this is done and the repair is made in the street that will permit the wagon to be taken to the garage, but if it can be towed the load is delivered and another wagon is given to the driver to continue his work. Then the disabled vehicle is towed to the garage. So expert have the emergency men become that they can handle a towed wagon through traffic and often keep to the schedule requirements. Sometimes, if the machine can be operated, but has not power, the emergency wagon will be driven behind it, pushing it up grades and along through snow.

Type of Enclosed Body on Garford Truck That Has Been Discarded by the Postal Service for the Standard Express Type.

With the conditions as they are, with the machines worked to the limit, it is not practical to make comparisons with what might be accomplished with animals, but it is the belief of Supt. George N. Magee that it would require more than 600 animals to do the work that is now being done with the 67 machines. The horses, wagons, harness, and other equipment would mean a very large investment, and horses do not last long in this kind of service. The animals cannot be favored and it is policy to keep the equipment at the lowest point possible. With the animals a considerable expense would be ferry charges, which run as high as 60 cents with some ferries, and with the numerous

hauls to Jersey City the aggregate is a considerable sum daily.

The company has plans made that will, if it receives the new contract, mean the purchase of additional equipment and the establishment of a large garage, but this cannot be determined until the result of the bids is announced. As the vehicles are worked it is not possible to make comparative statements that would be applicable to other service, but it is certain enough that there is not another fleet of wagons that does anything like the volume of haulage that is done by these 67 machines.

S. A. E. SEMI-ANNUAL MEETING.

Will Entertain British Institution of Automobile Engineers for 18 Days.

The members of the British Institution of Automobile Engineers who will be the guests of the Society of Automobile Engineers, and who will participate in the semi-annual meeting to be held at Detroit, will arrive in New York on the steamship Minnewaska May 26. The visitors, several of whom will be accompanied by members of their families, will number 40 or more. They will be received by the officers of the society, the general committee of arrangements and the New York local committee. The first day will be devoted to a baseball game and a dinner and the second day to sightseeing and the May session of the metropolitan section of the S. A. E.

May 28 the visitors and the S. A. E. members will go to Pittsburg, remaining there a day and leaving the evening of May 29. The morning of May 30 the company will reach Indianapolis, and will witness the races at the speedway, leaving there the evening of May 31 and reaching the city of Detroit the morning of June 1.

Monday, Tuesday and Wednesday until 3 in the afternoon, will be devoted to visiting several of the manufacturing plants, theatre party and a banquet, and then the members of the S. A. E. and their guests will embark on the steamer Detroit III, reaching Sault Ste. Marie the evening of June 5 and leaving several hours later for Mackinac island, where a stop will be made the afternoon of June 6.

The return will be made to Detroit, which will be reached at 3 the afternoon of June 7, and that evening the visitors will depart for Cleveland, where they will arrive the morning of June 8. The day will be devoted to sightseeing and the following day to visits to different plants and to tire factories at Akron. The departure will be made the evening of June 9 for Buffalo, where the day will be given over to a visit to the Pierce-Arrow Motor Car Company's plant and to Niagara Falls.

Here the party will divide, some going to New York and the others to Providence, where June 11 a day will be passed at the works of the Brown & Sharpe Manufacturing Company. That night the visitors will go to Bridgeport, where the morning of June 12 will be devoted to inspection of several manufactories, and that afternoon the journey will be made to New Haven by automobile. The night will be passed there and the following day the engineers and their guests will be driven to Hartford, where several automobile, tool and tire factories will be inspected. The return to New York will be made by boat, which will be reached the morning of June 14.

The programme of the morning session, June 5, following the transaction of business, will include reports by Henry Souther, chairman of the iron and steel division, and by David Fegusson, chairman of the ball and roller bearings division; papers by Enrique Touceda on the "Manufacture and Physical Properties of Malleable Iron," by K. W. Zimmerschied on "A New Tensile Test-Piece and Holder," by Paul W. Litchfield on "Pneumatic Tires," and by Harry Tipper on "Lubricating Oil," while the topics for discussion will be the "Design and Treatment of Leaf Springs" and "Worm Gears."

The afternoon session the same day will be devoted to the commercial vehicle section, and will include papers by T. B. Browne, president of the Institution of Automobile Engineers, on "Public Service Vehicles"; by Thomas Clarkson of the Society of Motor Traders & Manufacturers, on "Steam Buses"; by Charles Wheeler of the Institution of Automobile Engineers, on "Calculating Depreciation of Commercial Automobiles"; by Arthur M. Laycock on "Jackshaft versus Double-Rear-Wheel Brakes"; by Arthur J. Slade on "Metal Wheels"; reports by William P. Kennedy as chairman of the truck standard and commercial car wheel divisions, and "Comparative Efficiency of Solid Motor Tires" will be discussed.

The morning session of June 6 will be given to papers by F. F. Beall on "Automobile Production Inspection Methods," by F. E. Moskovics on "The Influence of the Sales Department on the Design of Motor Cars," by George W. Houk on "Wire Wheels," by Claude E. Cox on "Motor Construction"; reports by Chairman Andrew L. Riker of the electrical equipment division, by Chairman C. W. Spicer of the broaches division, by Chairman Henry Souther of the pleasure car wheels division, by Chairman Elliott J. Stoddard of the nomenclature division, by Chairman Arthur Holmes of the miscellaneous division; and to the discussion of "Electric Motor Starters," "Possibilities and Limitations of Utilization of Electricity in Operative Motor Car Function," "Possibility of Weight Reduction in Motor Car Design" and "Hobbing Methods."

The concluding session the morning of June 7 will include papers by E. B. Wood of the Institution of Automobile Engineers on "Engine Testing"; by Herbert Chase on "Motor or Carburetor Test Data"; by Prof. L. V. Ludy on "Tests of Automobiles"; a report by Chairman John O. Heinze of the motor testing division, and there will be discussion of the subjects of "Gasoline Motor Fuels," "Carburetor Nozzle Action" and "Motor Manifolds."

THE G. C. KEROSENE VAPORIZER.

NEARLY a year ago MOTOR TRUCK presented to its readers a description of the G. C. heavy fuel vaporizer, the invention of a Roumanian engineer, which was fitted to a large number of trucks in the service of an English company. Since the publication of the article the vaporizer has been improved and it is now being manufactured by the G. C. Vaporizer Company of America, Inc., 1790 Broadway, New York City.

The difficulty attendant upon the use of heavy fuels, that of vaporization, is held to be overcome by the G. C., which utilizes the exhaust gases of the motor in a novel manner. The engine is started on gasoline with the conventional type of carburetor and after being run a few minutes to obtain the desired heat, is then operated on kerosene, the vaporization of which is accomplished independently of the carburetor. A feature of the G. C. is that it may be employed with any type of internal combustion motor without alteration or interfering with the use of the usual carburetor and fuel. This is an advantage as it would permit of utilizing gasoline or kerosene as desired.

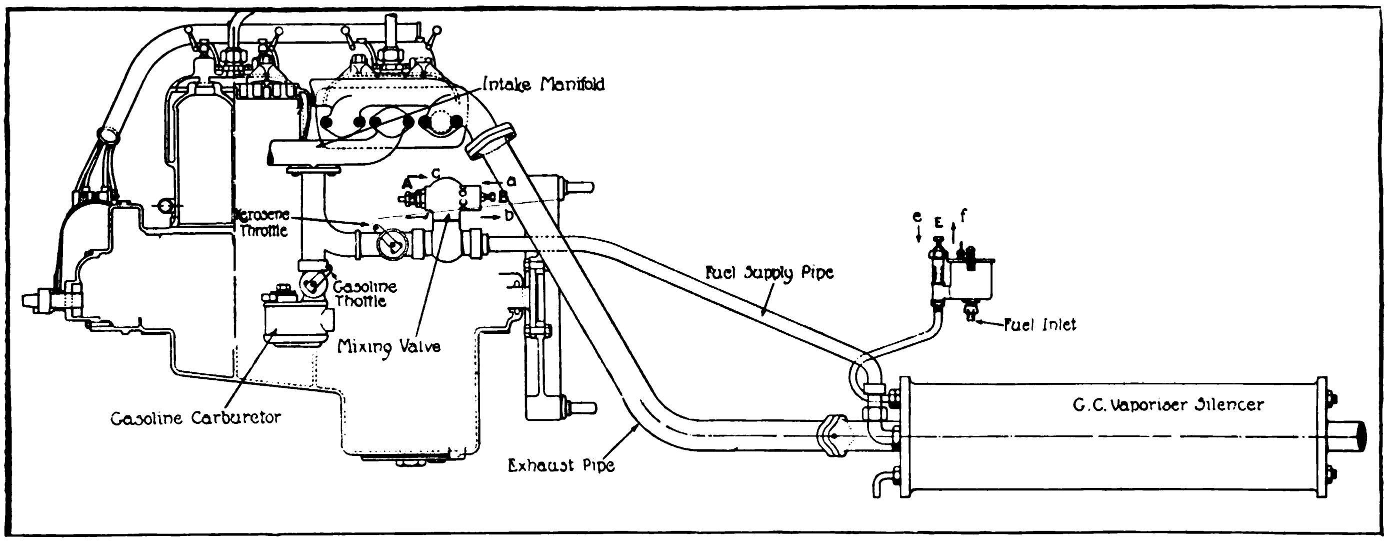


Fig. 1—G. C. Vaporizer, Replacing Usual Muffler and Vaporizing Heavy Fuels by Utilizing Heat of Exhaust Gases in a Novel Manner—Its Use Does Not Interfere with Operation of Motor on Gasoline, Making for a Dual Fuel System.

As will be noted by the accompanying illustrations the vaporization of the heavy fuel is obtained by a specially designed muffler, or vaporizer as it is termed, and the vapor is led to a mixing valve piped to the intake manifold of the engine. A longitudinal section of the vaporizer is shown at Fig. 2, also an end view and a section. The general arrangement is presented at Fig. 1. It will be seen that it differs from the gasoline carburetor in that no attempt is made to atomize the fuel as it issues from a jet. Instead, the heat of the exhaust gases is employed to slowly distill and vaporize the kerosene or heavy fuels.

The exhaust gases of the motor enter the vaporizer and go through three complete passages before passing out at the exhaust inlet. The kerosene is drawn into the vaporizer by a partial vacuum produced by the suction of the motor and passes through a horizontal pipe having a larger number of holes .145 inch in diameter. The fluid percolates through these fine openings at the rate of about 25 drops at a time, and coming in contact with the particles of cast iron utilized to retain the heat, is instantly vaporized. The metal mass is so arranged as to permit of the passage of the kerosene vapor, mixed with ordinary air, at very low speed and at a very high temperature of from 550 to 750 degrees Fahrenheit. The mixture ultimately obtained is at the comparatively low temperature of about 122 degrees Fahrenheit owing to the introduction of the outside air in the air mixing valve. The homogeneous mixture is drawn into the cylinders, compressed and burnt in the usual manner after passing through the mixing valve.

Regulation of the fuel is by a float chamber supplying a small standpipe having a normal level slightly below the top of the pipe. The amount of kerosene entering the vaporizer may be termed to be automatically regulated in that it is proportionate to the opening of the throttle or vacuum created by the motor.

Changes in the temperature due to varying motor speeds are compensated for by the heat absorbing material. At high ratios the metal pieces hold the heat in reserve, while at low ratios it is given off more freely, and retaining as it does the high temperature for a considerable length of time, it is possible to start on the heavy fuel. It is held to be possible to start the motor after it has been inoperative for as long a time as two hours.

The G. C. is not designed to permit of starting the motor when the latter is cold. The conventional carburetor and gasoline are utilized until the vaporizer becomes warm—usually after the machine has been run a mile—after which the kerosene is employed. The volume of heavy fuel mixture passing to the cylinders is regulated by a throttle incorporated with the air mixing valve. To simplify the bi-fuel control the or-

dinary carburetor level is actuated by the hand member on the wheel and the kerosene mixture regulated by the accelerator.

The adjustments of the air mixing valve and float member are simple. If the motor shows signs of smoking on a full charge the screw A is moved in the direction of d. If it backfires the screw is rotated in the direction of c. Adjustment for low speed is secured by the screw B, this being moved in the direction of a for smoking and of b for backfiring. Further adjustment is provided by moving the screw E of the float member in the direction of e and f, for smoking and backfiring respectively. After one proper adjustment it is claimed that the vaporizer will not require any further attention other than filtering of the fuel.

It is stated that there is a considerable reduction in the fuel consumption, this running as high as 30 per cent. in some instances. There is also a corresponding saving in lubricating oil due to the saturation of the kerosene vapors by light oils, and an instance is quoted in which a truck operated 4000 miles

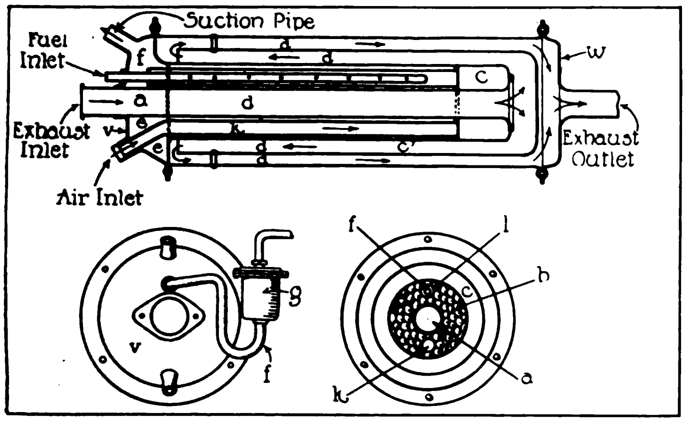


Fig. 2—Longitudinal Section of G. C. Vaporizer, End View and Section; a, c, Accumulator Jackets; b, Heat Accumulating Bodies; d, Exhaust Expanding Room; e, Gas Room; f, Perforated Tube; g, Kerosene Pipe; k, Air Pipe; l, Kerosene Pipe Protector; v, Front Cover; w, Back Cover.

with the vaporizer without sooting the plugs, valves, etc.

The use of other fuels than kerosene is possible; in fact the G. C. has been operated abroad on alcohol, ordinary methylated spirit, heavy petroleum, etc. Although new to this country the vaporizer has been successfully employed in England for about two years and in addition to being adapted to mechanical transports may be utilized on lighter vehicles. Aside from fitting a simple tee to the manifold to allow the kerosene mixture to reach the cylinders the utilization of the G. C. vaporizer does not involve any changes in the design or construction of the power plant.

The city of Huntington, Ind., has declined to grant a franchise for a street car line and has substituted in its place a motor omnibus service under a 20-year franchise. Huntington is the first American city to adopt motor 'buses to the absolute exclusion of street cars. Four machines for this service have been built by the White Company, Cleveland, O., the manufacturer of White trucks.

SUPPLANT RAILROAD SERVICE.

Large New York Grocery House Finds Garford Trucks Superior for Delivery Work.

The superintendent of delivery for the house of James Butler, New York City, one of the largest in the grocery business, recently stated that the company would never use the railroads again as the motor trucks had beaten them at every turn. Mr. Butler was one of the first business men in the United States to recognize the value of the mechanical transport, according to the superintendent. In 1909 he began, cautiously, to experiment with the motor propelled delivery wagon in comparison with the methods he then employed. A few weeks only were necessary to convince him that from an economic standpoint the horse had outlived its usefulness.

Mr. Butler's determination to discontine the use of railroads in transporting goods from his New York warehouse to the several score retail stores he maintains in New York, New Jersey and on Long Island, some of them 50 miles from the base of supplies, came when his latest order of Garford trucks, made by the Garford Company, Elyria, O., was delivered. The company now operates 16 Garford trucks, five five-ton, one two-ton and 11 one-ton machines, which have been found to be more efficient and economical than either freight or express service. Two of the lighter machines are used in special delivery work to the metropolitan branches, besides being called upon frequently to handle shipments of butter, eggs and vegetables to the suburban branches.

CO-OPERATIVE DELIVERY SYSTEM.

Three Merchants in Minneapolis Adopt This Plan, Utilizing Six KisselKar Trucks.

Now that motor delivery is a demonstrated success, merchants in several cities are using it on the cooperative plan. In Minneapolis, Minn., three of the leading concerns have a central clearing and routing station and use six KisselKar trucks, made by the Kissel Motor Car Company, Hartford, Wis., in making collections and deliveries. One of these machines makes five calls daily at each of the stores, collects the packages and takes them to the garage.

There they are sorted and assigned to the five remaining cars, each one of which makes three trips daily. The cars are each manned by a neatly uniformed driver and assistant. It is stated that the cost for delivery is about one-half that of horse haulage.

The Ritter Cigar Company of Detroit has a KisselKar truck, made by the Kissel Motor Car Company, Hartford, Wis., which in more than a year's running has not cost $1 for repairs. The operating expense of this truck, according to President H. G. Ritter, has been confined to fuel, lubricants and driver's wages.

NEW CHASSIS CONSTRUCTION DETAILS.

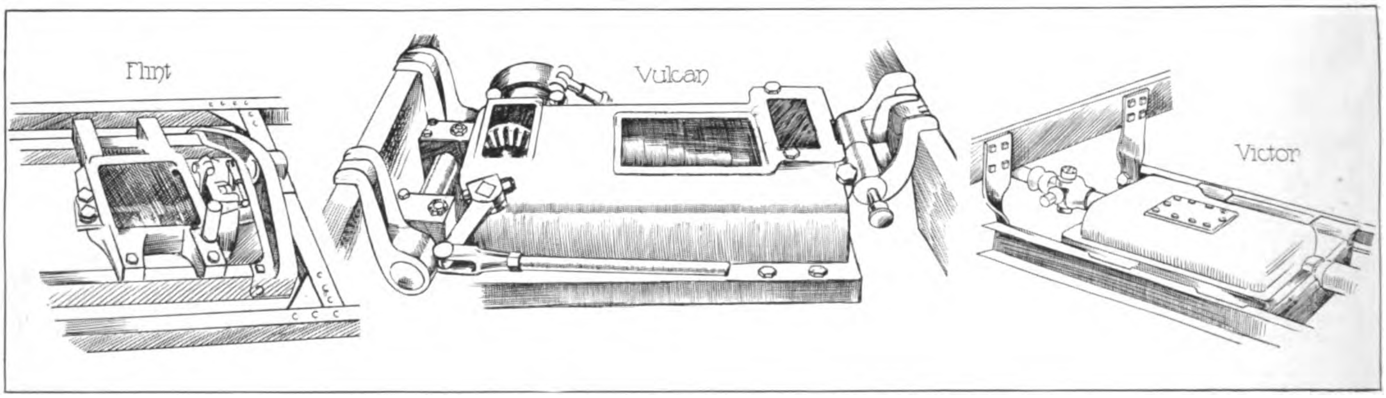
How Designers Have Improved the Suspension of Gear Boxes, Developed Torque and Radius Rods, Brakes, Mudguard Brackets, Springs and Shock Absorbers.

CAREFUL observation of the constructional details of differing motor vehicles shows that the engineers have given attention to what may appear to be factors of minor importance, and there are those who may assume that these are inconsequential in development. While it is true that no design is free from criticism when endeavor is made to combine every desired quality, and to eliminate every possibility, there is no doubt whatever that perfection of whatever may evidence the possibility of improvement generally means the strengthening of the weakest link. The items of fuel and tire expense prompt the elimination of weight through the use of better material or changed construction, and the cost of maintenance and depreciation impels a large factor of safety and the increase of wearing surfaces of moving parts. Protection of areas in frictional contact against abrasive wear, the reduction of vibratory stresses, the improvement of lubrication, making provision for adjustment and compensation for wear, the better alignment of linkage, minimizing strains from distortion, simplification of form and the reduction of production cost are some of the objects sought by the men who study vehicles constantly and in every form of service.

The protection of the transmission gearset against stress of chassis distortion, when it is not incorporated with the power plant unit, has been studied by practically every vehicle designer. One of the reasons for combination with the motor and clutch is minimizing the strains resultant from road shock, and with the assembly carried in a sub-frame varying constructions have been utilized to reduce vibration. Where the gearset is a separate unit and is located between the jackshaft and clutch, or between the clutch and rear axle, the proportions of the chassis frame are of much importance.

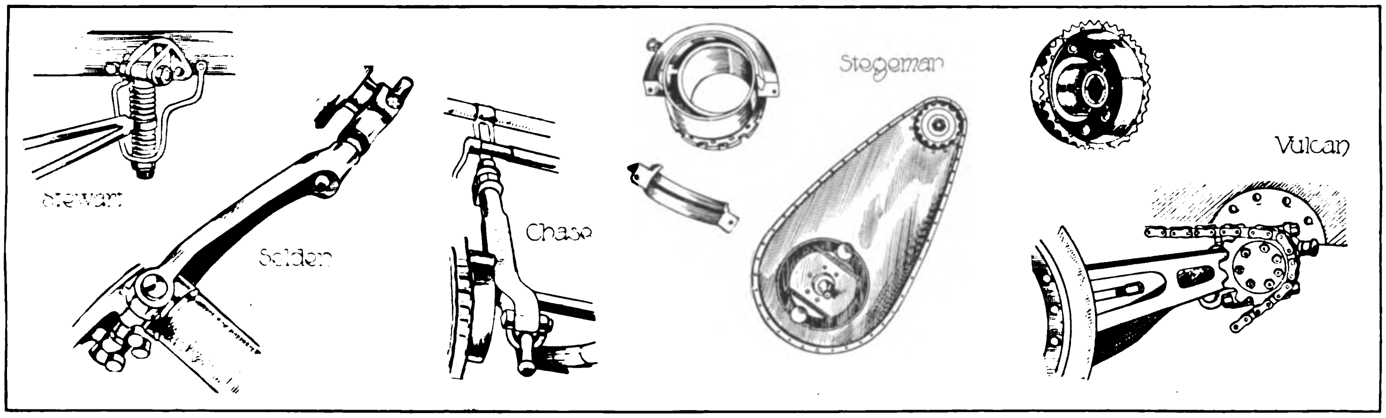
The purpose of many designers is to suspend the gearset or the sub-frame at three points, and an example of this may be noted in the Flint delivery wagon, which is shaft driven. The motor, clutch and gearset are carried in a sub-frame, the forward end of which is supported at the front end of the chassis at either side of the frame. The rear cross member of the frame, however, is curved, and is a sturdy channel section. In the centre of this member is a trunnion that is mounted in a bracket carried on the centre chassis frame cross member, there being a liberal bearing for the trunnion. The gearset is close to the end of the sub-frame and is carried on four supporting arms. Any movement of the side members of the chassis frame does not affect the gearset.

The design of the seven-ton Vulcan truck chassis gearset installation is another adaptation of the three point support. This case is in combination with the jackshaft, differential and gears, which are housed at the after end. The housing is very large and heavy, and it is in two sections, the upper having three cover plates, which may be removed for inspection or work. The forward end of the case is supported by a single bracket in the centre of a frame cross member, and at the rear it is carried on a shaft that extends through two arms forming a yoke, and two large lugs at the extreme end of the case. The rear yoke arms are secured to a chassis frame cross member. The transmission brake drums are at either side of the gearset case, inside the frame, and one of these is shown in the accompanying drawing. Another form of construction is seen in the Victor truck, where the transmission gearset is carried in a special sub-frame, this consisting of two side members of angle steel supported at either end by heavy steel straps twisted to permit easy riveting. On this frame the gearset case is carried by four long flanges at the sides of the case.



The Rear Sub-Frame Suspension of the Flint Wagon, the Three Point Support of the Vulcan Truck Gearset Case, and the Victor Gearset Installation.

The support of the forward end of the skeleton torque rod of the Stewart delivery wagon is a bracket on a frame cross member, lugs and a bolt holding the upper end of a guide for the rod, which is installed between helical springs. The lower end of the guide



The Torque Rod of the Stewart Delivery Wagon, the Selden Radius Rod, the Chase Radius Rod and Spring Support, the Stegeman Combined Chain Case and Radius Rod, and the Vulcan Radius Rod Adjustment.

carries a collar retained by a nut, and the relation of this guide is preserved by a forged yoke, the ends of which are riveted to the frame member, at either side of the bracket. While very light, the design is extremely strong and serves every purpose.

The radius rod of the Selden delivery wagon is of unusual design in that it is curved slightly to a point about a third of the length from the forward end, where there is an offset. The forward section of the rod carries a spherical bearing that encompasses the jackshaft housing, and on which it is free to move. The two sections of the rod are coupled by a right and left screw threaded into them. The rear end of the rod is clamped to the rear axle, on which it is free to move in a horizontal plane, while the spherical bearing at the forward end compensates the chassis distortion and maintains the relation of the axle. Ample provision for lubrication is made.

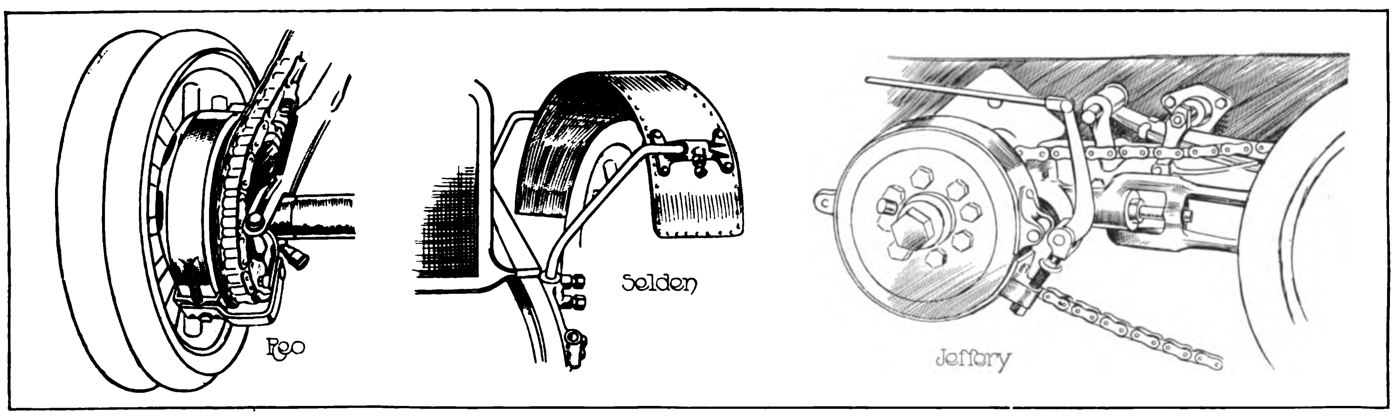
The radius rod of the 500-pound Chase wagon is designed so that it is mounted to move freely on the rear axle, the forward end being connected with the chassis frame. From the bearing on the axle the rod is curved upward, and the rear end carries a shackle in which the end of the rear cross spring of the vehicle is hung.

The chain case is made to serve as a radius rod in Stegeman wagons and trucks. The case is of pressed steel with an aluminum cover plate secured by cap screws. The case carries the shoes of the internal expanding brake, taking the place of the flange usually mounted on the rear axle, and the forward end is supported by an eccentric spherical bearing on the jackshaft housing by which adjustment may be made. The driving shaft sprockets are outside of the eccentrics. The eccentrics may be adjusted without removing the covers of the chain cases. The combination saves weight, insures the correct relation of the rear axle, and affords the fullest protection to the brake, chains and sprockets. The cover plates have inspection holes at the forward ends, through which lubricant may be introduced as desired.

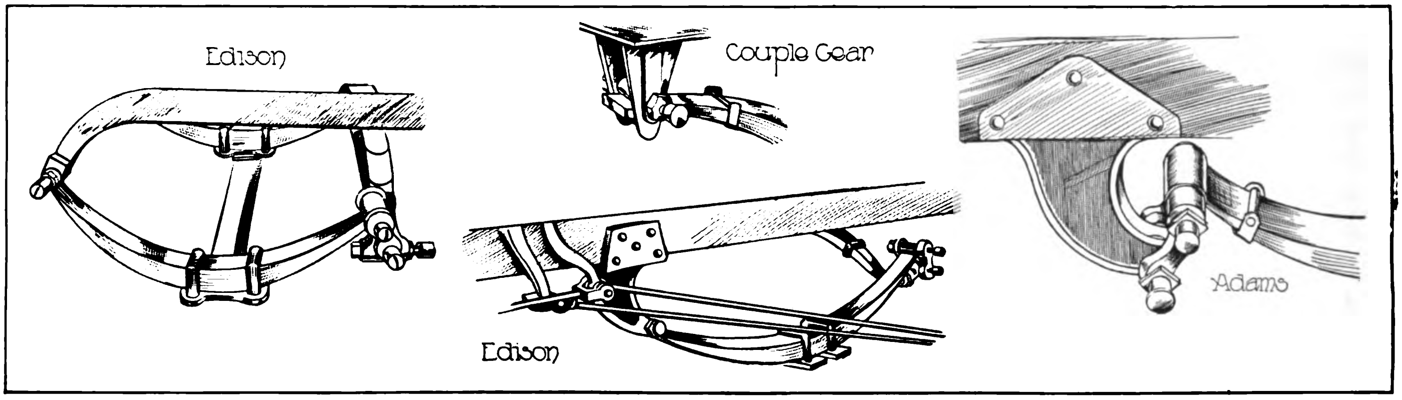
The radius rods of the Vulcan wagons and trucks are unusual in design in that the adjustment is made at the rear end by a rod that is threaded in the cross webs of the skeleton casting. This rod bears at the centre of the forward section of the bearing about the rear axle. The forward end of the rod is coupled to the jackshaft, on which it has a vertical movement, and there is horizontal movement provided for at the rear end. The end of the adjusting rod is squared to take a wrench, and the rod is held by a check nut.

The emergency brake of the Reo 4000-pound delivery wagon is the external contracting type, the bands encompassing drums 17 inches diameter and two inches wide on the rear wheels. Inside of this brake drum the rear sprocket is mounted on the wheel, and the sprocket is slightly smaller than the brake drum so that when it is desired to remove the wheel the sprocket may be drawn through the brake band without difficulty.

The manner in which the mudguards of the Selden



The Sprocket of the Reo Wagon That Can Be Drawn Through a Brake Band, the Mudguard Bracket of the Selden Wagon and the Grouped Brake, Spring and Radius Rod Connections of the Jeffery Wagon.



The Forward Platform Spring of the Edison Electric Wagon and the Method of Driving Through the Rear Side Spring, the Couple-Gear Spring Hanger and the Adams Rear Spring Connection.

delivery wagon are mounted makes for extreme accessibility. The brackets are carried higher above the frame than with the usual construction, and on the guards are riveted cast sockets. The ends of the brackets fit the sockets and are clamped by set screws. By loosening two screws a guard can be removed in a minute of time.

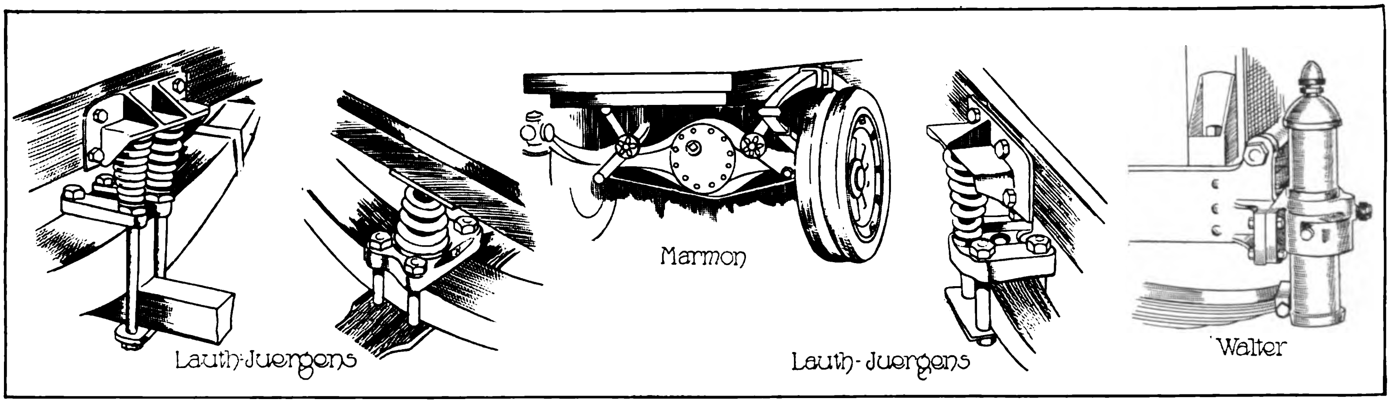
In the Jeffery one-ton delivery wagon much attention was given in the designing to minimizing the labor necessary in care and maintenance, and this is shown in the combination illustrated, where the forward spring hanger and shackle, the emergency brake shaft and draw rod, the radius rod adjustment and forward end coupling and the service brake on the jackshaft are so grouped that any of them can be adjusted or given any other attention almost instantly.

A novelty in spring suspension is the use of the platform construction for both the front and rear axles of the 1500-pound Edison electric wagon. In this wagon the spring horns are sharply curved downward and the arc of the semi-elliptic side springs is more pronounced than is usually noted in such members. The reason, however, is to bring the rear ends high, and from these to carry the shackles that couple the cross spring, which has approximately the same arc as the side springs. The rear spring construction is also unusual in that there are no radius rods and the drive is through the springs. These are bolted to the spring hanger, which has a shape that closely conforms to the arc of the spring. A large grease cup lubricates each bolt. There is a torque arm from the differential housing of the full floating rear axle to a frame cross member beside the motor, the drive being by worm and gear. It will be noted that both brake rods are outside the frame, where they are easily accessible.

The forward end of the heavy front spring of an Eldridge or Couple-Gear truck is mounted in a hanger where the weight is carried on a roll and spindle through the hanger, this permitting free longitudinal movement of the spring and yet having all of the driving strain sustained by the whole spring, and not by the master leaf. The construction of the forward hangers of the rear springs in the Adams machines is exceedingly heavy and the form is intended to afford easy movement without severe stress. Both shackle bolts and the eyes of the hanger and spring are lubricated by grease cups.

In the Lauth-Juergens wagons and trucks the auxiliary springs are of the helical type. These are coiled in cone shape and for the trucks two are used for each rear spring. The springs are installed with the small ends mounted on extensions of the bolts retaining the outside ends of the spring saddles, and the upper ends are in contact with a hood bracket fixed to the frame. With the delivery wagons one spring is similarly used at the rear springs. For the trucks one spring is used forward, but with the delivery wagon a single spring is fitted with the base of the cone secured to the spring saddle and the upper end contracting against the side member of the chassis frame.

The Marmon light delivery wagon has a well known shock absorber installed between the axle and



Some Examples of Minimising Spring Stress: The Lauth-Juergens Helical Auxiliary Springs for Wagons and Trucks, the Friction Shock Absorber of the Marmon Wagon and the Pneumatic Shock Absorber of the Walter Truck.

the chassis frame by special sittings, the absorbers having a transverse instead of a longitudinal movement. The Walter trucks are equipped with Westinghouse pneumatic shock absorbers fitted between the forward ends of the springs and the chassis frame, the installation making a novel appearance. The result is said to be very satisfactory.

ELECTRIC MEN HEAR LABOR'S VIEW.

Attitude of Union Drivers Toward Motorized Equipment Stated by General Organizer.

The attitude of labor, as represented by the Teamsters' Union, was reflected at a meeting of the Electric Vehicle Association of America held in New York the evening of April 22, when a paper prepared by Daniel J. Tobin, general president of the International Brotherhood of Teamsters & Chauffeurs of America, was read by William H. Ashton, general organizer of the brotherhood. The meeting was presided over by Arthur Williams, president of the association, who stated that there were today opportunities for 46,000 men as drivers in this country, and that before the end of the year this number would be increased to 50,000.

The membership of the brotherhood was stated as 62,000, and it was emphasized in the paper that there was no controversy so far as the members were concerned in the use of motorized equipment. To the contrary there was several times reiteration that the union realized that commercial and industrial progress made the motor vehicle necessary, and the members who were drivers found that there was a decided betterment of conditions where the machines were used. The statement was made that the union men made the best drivers because they had experience with traffic and handling loads; that they were not opposed to doing other work outside of the operation of the vehicles; that as a rule they are men who have realization of their responsibilities and are practical and care taking in their work.

It was maintained that "In our particular trade or calling our employers are breaking in their drivers or employees and transferring them from the horse-drawn vehicle to the motor vehicle. Ninety per cent. of our chauffeurs in every city and town who are members of our organization were formerly teamsters or drivers. They have been transferred from the wagon to the automobile. They are doing the same work as they were doing formerly. We are thoroughly satisfied with the change and our work in nearly every instance is becoming easier. For instance, on Sunday morning, we have no stable work to do. We can stay with our family and the horses do not have to be cared for. This applies also in inclement weather and to the very warm weather. The driver does not need to worry when going up hill about the strain on his horses if he is driving a motor vehicle. The advantages obtained from the change are too numerous to mention herein."

Another phase was developed when the paper stated that:

"When the motor vehicle was first introduced into our American lives it became a fad for the riff-raff and good-for-nothing individuals who hang around the street corners, to become chauffeurs; men who had no knowledge or judgment as to space, location, etc. Because such a class was willing to offer its services for practically nothing, employers foolishly believed they were saving money by employing this class, but the intelligent individual or employer who understands anything about commercial life knew that it was cheaper to hire a man of judgment and understanding, who has the responsibility of a home and family, who is clean in life and healthy in body and mind, than to employ a careless individual in the operation of a motor vehicle." With reference to the belief that the union opposed the use of trucks and wagons, it was maintained that the general policy of labor was to recognize that the use of machines increased labor instead of reducing it.

During the discussion that followed the paper it was developed that in New York at least there was a jurisdictional controversy between the brotherhood and the Brewery Drivers' Union, and as both are affiliated with the American Federation of Labor and there had been no determination of the difference, the interests of each organization are controlled by it. This fact was developed from the statement that there had been difficulty experienced by one man at least in selling brewery trucks from the fact that the brewery drivers required two men on each machine and would not permit the driver to assist in loading or unloading.

It was explained by the reader of the paper that the brotherhood was directly interested in the progression of its members, and he stated that the local unions of New York, Chicago, Boston and perhaps elsewhere, had purchased trucks for the purpose of teaching members to operate them, so that they would be capable of driving machines in the event of the change of equipment by their employers. This statement resulted in the educational committee of the association being instructed to assist the union in the development of its members as drivers in any manner that would be practical and beneficial.

Edgar T. Ward, for years president of Edgar T. Ward & Sons, dealer in steel at 23-25 Purchase street, Boston, has retired from active participation in the affairs of the company, which will be continued by his two sons, John and Edgar Ward, under the firm name of Edgar T. Ward's Sons. He has also retired as president of the Union Twist Drill Company, Athol, Mass. He was presented a silver loving cup at a banquet given in his honor at Young's Hotel, Boston, by the officers and salesmen of the company of which he was so long the head, and of the George Nash Company, New York, N. Y., and Chicago, Ill., and of Field & Co., Philadelphia, in recognition of his eminent success as a dealer in metals.

BETTER WORK AT LESS COST.

Forth Worth, Tex., Gas Company Profits by Use of Commerce Wagons.

The Fort Worth Gas Company, Fort Worth, Tex., has in service two Commerce motor wagons, made by the Commerce Motor Car Company, Detroit, the first of which was purchased through a display made at the Dallas fair last October, and was delivered and placed in commission Nov. 7, and the second was delivered Feb. 6 of the present year. Fort Worth and its suburbs are a community with a population of more than 100,000 and it covers a considerable area. The work of the company is widely extended and it is constantly increasing. The first machine was a model C chassis with a panel body, which was placed in service in the meter setting department, where it displaced a two-horse team and wagon and a single horse and wagon. With the installation of the vehicle it was found that the services of two men could be dispensed with.

Commerce Model C Wagon in the Meter Department of the Fort Worth, Tex., Gas Company, Saving $91.65 a Month as Compared with Horse Work.

Careful observation was made and accurate record kept of the work and the cost when the change was made, comparison being made with previous expense for the department, and it was found that doing the same work and doing it better the net saving was $91.65 a month. During the period of observation, to April 18 of this year, the mechanical expense for the machine was $3.75, the cost of replacing a fiber ring Feb. 16. The record of the machine shows that it has been driven an average of 37.2 miles each working day with a monthly expense for oil and fuel of $9.50.

The result of the use of the model C was that a model A machine, equipped with an open express body, was purchased, and this was worked in the service department. When equipped, including the weight of the men and tools, the wagon weighed about 3000 pounds. This wagon has been driven an average of 25 miles each working day, and the fuel expense thus far has been $11.50 a month. The additional weight carried and that the service work is generally in sections of the city where the streets are unpaved are the reasons for the greater cost for gasoline and oil. The two wagons are doing the work for which five horses were used, and there is a considerable saving and the work is better and more rapidly accomplished.

NEW WORM DRIVEN MODEL.

Company Formed in California to Produce Machines Designed by Joslyn and Walton.

The Los Angeles Motor Truck Manufacturing Company, Los Angeles, Cal., has been formed to build a new type of motor truck, with underslung chassis, with a low centre of gravity and loading platform 21 inches above the ground, but having 11 inches road clearance. The company has purchased a 30-acre tract of land at Bangle Station, near Wilmington, Cal., Los Angeles harbor. Plans are being drawn for five large, reinforced concrete buildings, which will cost, together with machinery, materials, etc., over $300,000. About 250 men will be employed.

W. B. Joslyn, E. E., A. E., who has been connected with the automobile industry practically from its inception, and who for several years was in charge of the experimental department of the Studebaker Corporation, Detroit, maker of Studebaker commercial and pleasure vehicles, is vice president and general manager of the company. Mr. Joslyn and M. S. Walton, M. E., A. E., a designer of many years' experience, have worked out the new type of truck. The drive is by worm with all parts housed and protected so as to be dirt and dust proof.

The Spokane Grain Company, Spokane, Wash., recently replaced several of its horse delivery trucks with a five-ton Garford motor truck, made by the Garford Company, Elyria, O., having found the operation of the latter vehicle a considerable saving over its former methods. The truck covers more ground and does more delivery work than horses.

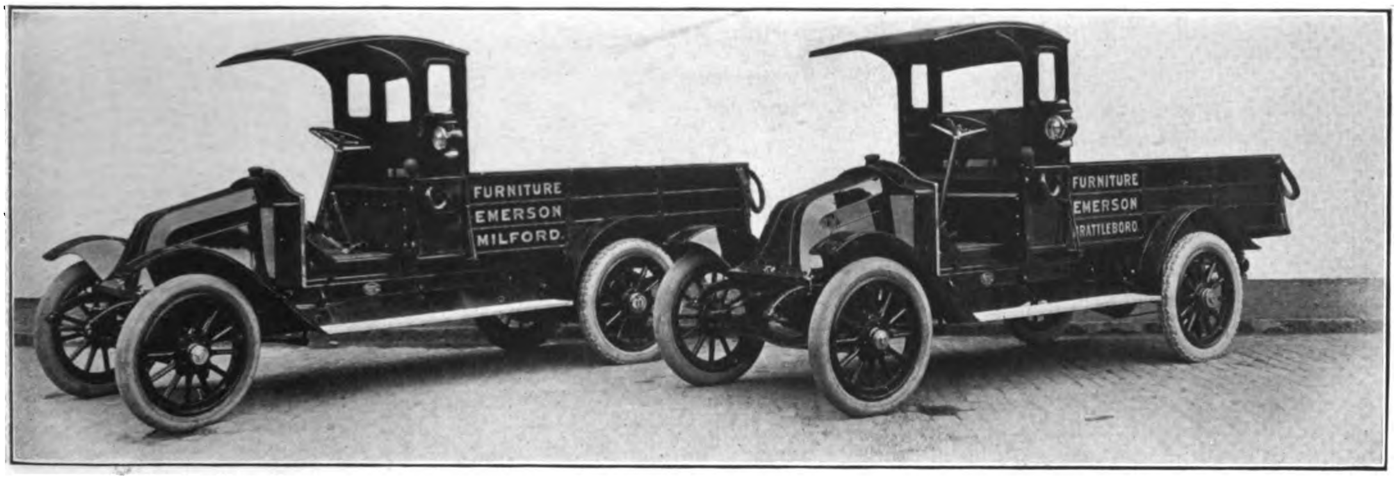
Charles E. Grace, manager of the White Motor Company, which is the Baltimore, Md., branch of the White Company, Cleveland, O., has been notified of the purchase of 15 trucks by the Atlantic Ice & Coal Corporation of Atlanta, Ga. The order calls for immediate delivery of the machines of three different capacities, 1.5, three and five tons.

STEWART 1500-POUND DELIVERY WAGON.

THE policy of concentrating its entire endeavors in the production of a single type of chassis which would be adapted to very widely differing service, has been followed consistently by the Stewart Motor Corporation, Buffalo, N. Y., maker of the Stewart delivery wagon. In keeping with this is the purpose to build as high a grade machine as is possible for a price that will appeal to those who desire a thoroughly dependable vehicle. The capacity has been fixed at 1500 pounds, and the speed permitted is proportionate to the load and the construction of the chassis. The head of the corporation is T. R. Lippard, president and manager, and R. G. Stewart is vice president and engineer, both having had long experience in motor manufacturing. The corporation will not build different types, but has standardized its vehicles and it is intended to continue the one chassis until the possibility of improvement shall be realized, and changes made will be without reference to seasons or years. units, and the design is such that any one group may be removed without dismantling or removing the others.

The motor is a Continental product, of the vertical L head, four-cylinder, water-cooled type, with bore of 3.75 inches and stroke of 5.25 inches, this having a rating of 22.5 horsepower by the S. A. E. standard, but with the bore to stroke ratio of 1:1.40 the statement of the maker that it will develop 30 horsepower is in every way conservative. This motor is believed to be in every way sufficient for a vehicle of 1500 pounds capacity.

The cylinders are cast en bloc from a fine quality of gray iron, with the water jackets integral. The entire top of the block is open, this permitting the water spaces to be cleaned, insuring that there shall be no obstructions and that the water shall freely circulate. The block is completed by the installation of a large cover plate in which is incorporated the water outlet



Two Stewart Delivery Wagons, Built for the Emerson Furniture Company, Brattleboro and Milford, Vt., Fitted with Open Express Bodies and Special Drivers' Cabs.

The Stewart delivery wagon was designed to meet what was regarded as the greatest requirement of the market, and to be suited to practically all forms of service where comparatively high speed is absolutely necessary. The chassis is fitted with six types of standard body equipment by the company, these including panel, express, open box, special express, stake platform and undertakers' installation. The express body is provided with a top, the open box body has a cape top and the special express body a standing top and wire grating sides. The chassis are sold without body when desired, and the bodies cost from $125 to $550 additional.

To insure the character of service—continued operation being the most important—sought by the designer, extreme care was taken to have the mechanism of the vehicle extremely simple and as accessible as was possible, it being realized that in many instances care and attention is more or less dependent upon the time required for the work, so far as the operator is concerned. Another factor was the independence of the manifold, there being a channel that increases in depth from the rear to the front of the plate, in which the movement of the water is directed to the outlet. The plate is retained by a series of cap screws, a gasket making a water tight joint.

In the manufacture the cylinder block is first bored and aged to eliminate danger of casting strains, after which it is reamed to size and ground and polished. The pistons are of the same material as the cylinder casting. These are turned and carefully ground. The pistons are five inches length. They are grooved for four rings of the diagonally split eccentric type, the rings and grooves being ground to careful fit, and there are five oil grooves that insure a perfect distribution of lubricant on the walls of the cylinders. The pistons are weighed and balanced before fitting.

The crankcase is constructed of high grade nickel aluminum alloy, in two sections, the upper half having four supporting arms and carrying the main and camshaft bearings, and the lower section having an oil reservoir below the base, a transverse web dividing it.

In this web are four channels into which the big ends of the connecting rods sweep. There is a large outlet in the oil reservoir by which it may be cleaned. The lower section may be removed for examination of or work on the crank and camshafts, bearings, etc.

The crankshaft is a .35 to .45 carbon steel drop forging that has a tensile strength of 90,000 pounds to the square inch, that is carefully hardened, heat treated and ground. It is mounted on three main bearings, which are respectively 2.75, three and four inches length from front to rear, and the shaft is 1.75 inches length. The total bearing surface length is 9.75 inches. This shaft is flanged back of the rear main bearing to take end thrust and prevent undue wear on the bearings. The bearings are high grade nickel babbitt, and after these are fitted they are extended in special extension arbors and reamed and scraped by hand. They are retained by brass retaining screws.

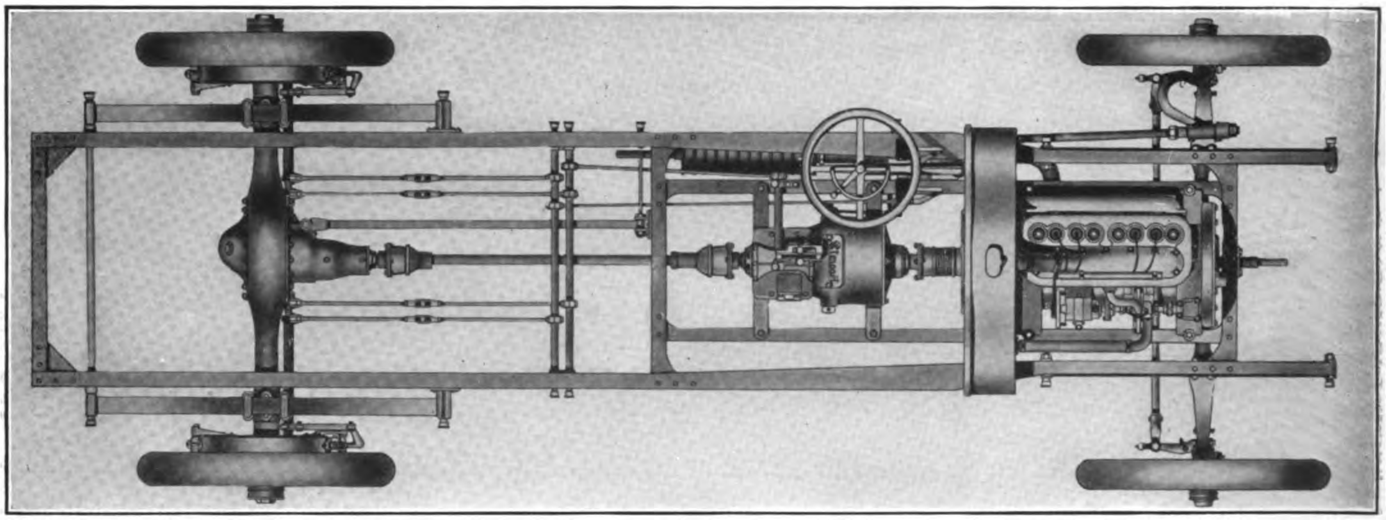
The connecting rods are drop forged steel I sections 10.5 inches length, and they are formed to carry big end bearings 2.5 inches length. The rods are heat treated to insure the greatest strength. The big end bearings are nickel babbitt, which are clamped by caps retained by nickel steel bolts and a special locking device. The bearings are fitted with steel shims, that they may be adjusted when worn, and similar provision has been made for the adjustment of the main bearings. The wristpins are of nickel steel and the generous bearings are of nickel babbitt. The camshaft is drop forged with the cams integral from a low carbon steel, and in making it is carefully ground, hardened and heat treated. The shaft is 1.0625 inches diameter and it is carried on three bearings, these being 2.3125, 1.5 and 1.25 inches length respectively from front to rear. These bearings are of nickel babbitt and are prepared as are the other principal journals of the motor. The design is such that the camshaft may be removed at the forward end of the motor by the removal of the cover of the timing gearcase.

The timing gears are contained in an extension of the crankcase and enclosed with a plate in the usual manner. The timing gears are large in size and wide of face, and are helically cut to prevent noise.

The valves have two-inch ports and the valve heads are of nickel steel, electrically welded to carbon steel stems. The ends of the stems are hardened to minimize wear. The valves are interchangeable. The valves and valve seats are accurately ground to size, there being sufficient clearance provided for to insure effective scavenging of the cylinders and the intake of ample charges of fresh fuel. The springs are large and well tempered. The valve tappets are chrome nickel steel and are mushroom type, being case hardened, and with heads and stems ground to size. The adjustment for wear is made by hardened screws and check nuts. The valve mechanism is enclosed in pockets that are enclosed with cover plates retained by wing nuts.

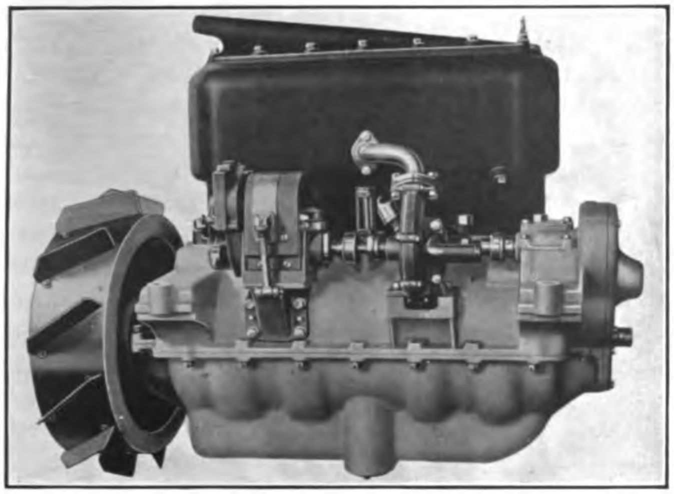
The intake manifold is integral with the cylinder block, there being a short riser by which the carburetor is connected. The exhaust manifold is a separate casting of conventional form.

The lubrication is effected by two plunger pumps that are actuated by an eccentric on the camshaft. The oil is drawn from a well in the reservoir, being filtered before entering the pumps, and is forced through a system of tubes to the rear main bearing and the timing gearcase. The drainage is into the pits or channels in the bottom of the crankcase, and the distribution to the crankshaft, camshaft and wristpin bearings, to the cams, tappets and piston and cylinder walls is by splash. Pockets accumulate sufficient oil to thoroughly lubricate the camshaft bearings at all times. The overflow of oil is carried to the reservoir, where it is filtered before it is again used.



Top View of the Stripped Chassis of the Stewart 1500-Pound Delivery Wagon.

The water is circulated by a centrifugal pump of large size that is driven by an outside shaft at the right side of the motor. The pump bearings are unusually large and the stuffing boxes are of proportions to insure long endurance. The radiator is a flat tube construction, but it has the appearance of a honeycomb design. It is mounted at the dash on helical springs to prevent damage from road shock and chassis distortion. The motor is covered with a hood of the Renault type, and the air is drawn through the radiator



The Right Side of the Motor of the Stewart Delivery Wagon Chassis.

by a series of blades carried on the periphery of the flywheel, and carried out under the floorboards. The ignition is by a high-tension magneto with a fixed spark, this eliminating a possibility of the motor being overloaded. It simplifies the system, minimizes the wiring leads, and insures against any complication. The carburetor is an automatic float feed type that will afford a satisfactory mixture under all conditions of operation.

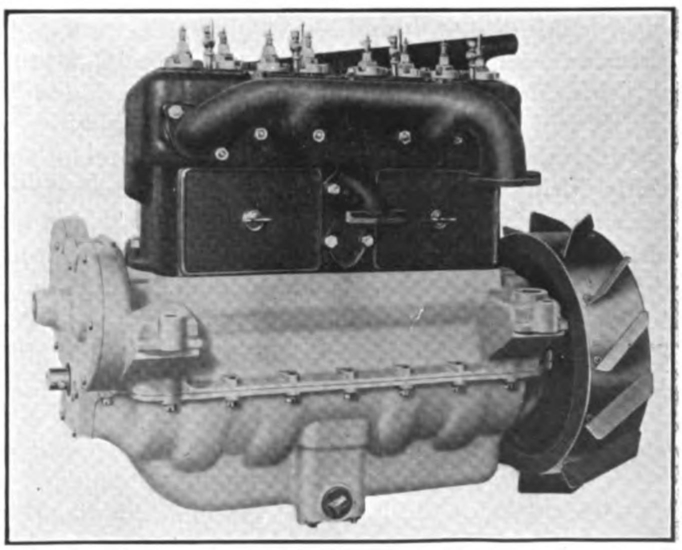
The clutch is a multiple disc design in which are 11 plates, nine inches diameter, five of which are faced either side with Raybestos and fitted between the other six. The clutch is positive and easy in its engagement, and it requires practically no attention. The clutch may be removed by taking off the front cover and removing the double universal joint between the flywheel and the clutch. The clutch case is integral with the transmission gearset case and it is a nickel aluminum alloy. The gearset is a Brown-Lipe construction that affords three forward speeds and reverse. The gears and shafts are large, of 3.5 per cent. nickel steel, double heat treated. The shafts are fitted with stuffing boxes to prevent leakage of oil and they are mounted on Timken bearings throughout.

The driving shaft is a high quality steel, 1.25 inches diameter, and there is a universal joint at either end to compensate for the changes in alignment from chassis distortion. The rear axle is a Timken construction of the full floating type, and it is carried in a pressed steel housing that is strengthened by a truss. The housing is reinforced by sleeves at either end which support the spring seats and carry the weight of the machine and its load at the wheels. The differential gears are large and are mounted on Timken bearings. The differential ratio is five to one. The front axle is a heavy I section. The pivots are fitted with Timken bearings, and this type of bearing is used with all wheel spindles. The tiebar, drag link and tail lever are steel drop forgings. They are installed behind the front axle for protection.

The frame is a high carbon steel channel section that is 4.5 inches deep at the centre and is tapered toward either end, with wide webs. This frame carries the sub-frame in which is mounted the motor and the transmission gearset, the supports of these units being designed to be easily removable if necessary. The frame is carried on semi-elliptic springs of special steel that is carefully heat treated. The forward springs are 38 inches length and two inches width and the rear springs are 50 inches length and 2.25 inches width.

The wheelbase is 126 inches and wheels are artillery type, 12 spokes, 1.625 inches diameter forward and 1.75 inches diameter rear. They are equipped with 34-inch tires, four inches forward and 4.5 inches rear, of the pneumatic type. The control is by the conventional pedals for the clutch and for the service brake, and the throttle lever is located on the steering column above the wheel. The steering wheel is at the left side. The steering gear is a worm gear construction with a worm of hardened steel, ground to size. The worm wheel is hardened steel, integral with the shaft. In this there is abundant provision made for adjustment in the event of wear. The gear changing lever and the emergency brake lever are located in the centre and are mounted above the transmission gearset case, being easily removable should there be need. The direct connection eliminates a number of parts. Two sets of brakes are installed, the service brake being internal contracting and the emergency brake external contracting in and on drums 17 inches diameter bolted to the rear wheels.

Much care has been taken to insure adjustment of the wearing parts and ample provision has been made to compensate for wear, which fact is evidenced by the use of high grade bearings, adjustable wherever necessary, and the construction of large surfaces wherever there is frictional contact. The same attention has been given to lubrication, all of the spring bolts being fitted with large grease cups, the pedal and brake shafts have grease cups outside of the frame where they are in every way accessible, and the steering gear is equally well lubricated. Wherever it is deemed necessary oil cups have been provided.



The Left Side of the Motor of the Stewart Delivery Wagon Chassis.

The standard bodies built by the company are designed with special reference to having the load well distributed, and these are suited for all ordinary purposes. The Stewart Motor Corporation has made very rapid progress since its organization and it is now building more than 50 machines a month. It is represented in 55 different cities and now has its vehicles in service from Edmonton, Alberta, to New Orleans, and from Seattle to Boston, besides having a very promising export business with various South American countries, where energetic agents are industriously exploiting them.

BUSINESS WAGON ACCESSORIES.

Chas. E. Miller Calls Attention to Some Specially Designed for This Use.

Chas. E. Miller, 97-103 Reade street, New York City, the pioneer accessory dealer, with branch stores in 15 cities and nine states, calls attention to the special fittings designed for service with motor business wagons. He suggests that this situation indicates the importance of this branch of the industry. He says:

"A few of these special fittings consist of anti-skid chains, such as the Federal, the Eureka and the Never-Skid. The first named is made with four bands, which fit almost completely around the tire and rim, and these bands are connected by chains on either side, the surface of the chain being shaped the same as the tire on either side so as not to injure the tire. The Eureka consists of a number of quadrilaterally shaped metal pieces connected by short chains so that the rough surfaces presented to the pavement have a cutting effect that resists side skidding. The Never-Skid is made for dual tires and has a series of frogs linked together, each frog being cast in the form of a cross, the central portion of which fits into the groove between the dual tires and prevents the chain from slipping off."

GEDDES SUCCEEDS KELLY.

President of Kelly-Springfield Motor Truck Company Retires on Account of Ill Health.

The many friends of E. S. Kelly, president of the Kelly-Springfield Motor Truck Company, Springfield, O., maker of Kelly trucks, will regret to learn that his health is such that he has felt compelled to retire from the active detailed management of the company. Mr. Kelly becomes chairman of the board of directors and will continue to exercise a general oversight over the affairs of the concern, but the details of the management will devolve upon James L. Geddes, who succeeds Mr. Kelly as president. He will be assisted by O. S. Kelly, who continues to be general manager.

The affairs of the company are in most excellent shape. The factory is running to its fullest capacity and the demand for the goods is sufficient to give every assurance of a prosperous future for the company. Mr. Kelly, while regretting his inability to continue as president, feels that he has secured a very competent successor in Mr. Geddes, who for many years was associated with Emerson McMillan, chairman of the board of the American Light & Traction Company, and who, with the firm of Emerson McMillan & Co., banker, holds a controlling interest in the truck company. Mr. Geddes has been connected with the Detroit City Gas Company for 14 years, joining its force in 1899, after a number of years with the Grand Trunk railroad in Port Huron, Mich., Detroit and Montreal, Can. His past business career has been such that the fullest confidence is felt as to his conduct of the truck concern.

Mr. Kelly was one of the pioneers in the rubber tire business. In 1894 he started the Kelly-Springfield Tire Company, which produced rubber tires for horse drawn vehicles. After promoting that company to a high production and financial efficiency, he retired from its board of directors and disposed of his stock. He remained inactive until about three years ago, when he purchased and reorganized the Frayer-Miller Motor Truck Company and began a campaign of development.

WINNIPEG MOTOR COMPETITION.

Annual Agricultural Contest at Canadian Industrial Exposition from July 1 to 16.

The annual agricultural motor competition in connection with the Canadian Industrial Exhibition will take place at Winnipeg, Manitoba, from July 1 to 16, and it is planned that it will be the largest and most interesting demonstration of efficiency to take place in Canada. All of the engines entered must be at the exhibition grounds the morning of July 1 and the first two days will be devoted to judging them for design and construction; July 3, 4, 5, 7 and 8 will be given over to brake tests, and July 10, 11 and 12 to plowing.

The classification will include three divisions, the first of which shall be for gasoline traction engines having a piston displacement of less than 300 cubic feet a minute, of more than 300 and not exceeding 500 cubic feet, and in excess of 500 cubic feet; the second will be for kerosene traction engines of the same classes with reference to piston displacement; the third will be for steam traction engines with piston area in square feet times 60 or less, from 60 to 100, and in excess of 100, the piston displacement to be the area of the piston in square feet times 700, which is established as the typical speed. In compound steam engines the high pressure shall be used and 10 per cent. added. The prizes will be gold, silver and bronze medals. All entries will be made on or before June 2. Competing machines must be stock construction and a blue print or photograph of a blue print of the boiler of steam engines must be approved by the Alberta inspector and accompany the entry.

THE SELDEN ONE-TON TRUCK.

THE accompanying illustration shows a Selden 2000-pound capacity delivery wagon in the service of Samuel Sloan & Co., Rochester, N. Y., a large dealer in plumbers' and steam fitters' supplies. This chassis is a regular stock production, with wheelbase of 145 inches. The body equipment was designed especially for the work required in the company's delivery, being heavily ironed inside and protected against damage and excessive wear resulting from the handling and haulage of large iron pipe and other heavy metal materials that would be particularly destructive to the ordinary unprotected wooden body.

The illustration shows the characteristics of the Selden machine, which include sturdy construction and extreme simplicity. The design was created to meet the exacting requirements of heavy haulage service, and all parts are constructed with unusually large factors of safety. Well established principles were not departed from, but endeavor was made to combine in a single machine every desirable quality and to have practical construction that is free from structural weakness and possible causes for failure.

The motor is a four-cylinder, water-cooled, L head vertical type, with bore of 3.75 inches and stroke of 5.25 inches, with the cylinders cast en bloc. The engine is rated at 22.5 horsepower by the S. A. E. rating, but it will deliver considerable in excess of this. The cylinder block is cast open and it is covered with a large plate secured by a series of cap screws. The water spaces are large and there is certainty of the motor being thoroughly cooled. The crankcase is a barrel type, with the upper section carrying the main and camshaft bearings, and the lower half includes the base and the oil reservoir, the latter being separated by a transverse web, in the upper side of which are the oil pits for the splash lubrication. The crankshaft, camshaft, connecting rods and timing gears are large and of high grade material. The bearings are of liberal proportions and designed for long endurance. The valve mechanism is protected against wear by being enclosed by plates secured by wing nuts that are readily removable.

The motor is cooled by a circulation of water, driven by a gear actuated pump of the centrifugal type, through a vertical tube radiator, and by a belt driven fan mounted on an adjustable bracket at the forward end of the construction. The lubrication is a force feed constant level system. The lubricant is drawn from the reservoir from a screened well by a plunger pump driven by an eccentric on the camshaft. It is forced through a system of tubes to the timing gears and the rear main bearing, and thence drains to the base of the crank chambers, where it is distributed by splash to all the moving parts of the engine. The excess from the crankcase is drained back to the reservoir. The ignition is by a high-tension magneto, with a battery of dry cells for starting and a reserve. The carburetor is an automatic float feed type that is said to give excellent results under any condition of operation.

The power plant is a unit construction in which the flywheel, clutch and transmission gearset are enclosed. The clutch is a multiple type with 13 steel discs, six of which are faced at either side with Raybestos and contact with the other seven plates. The clutch is operated without lubrication, and is extremely smooth in its engagement. The clutch is assembled with the transmission gearset, which is a selective construction, having three forward speeds and reverse.

A Selden 2000-Pound Delivery Wagon in the Service of Samuel Sloan & Co., Dealer in Plumbing and Steam Fitters' Supplies, Rochester, N. Y.

The gears and shafts, of nickel steel, heat treated, are of large size. The shafts are mounted on taper roller bearings throughout. The power plant is mounted in a sub-frame that protects it against the strains of chassis distortion.

The drive is by a driving shaft with a universal joint at the forward end to a jackshaft of the semi-floating type mounted in high duty roller bearings. The differential and driving gears are heavy and have an adjustment by a nut back of the thrust bearing. The drive shafts are a special alloy heat treated steel, 1.375 inches diameter. The jackshaft is supported in the frame on spherical bearings which compensate frame distortion. The drive to the rear wheels is by side chains. The frame is a steel channel section 5.625 inches width, .1875 inch thick, with wide webs. The front cross member is easily detachable with the radiator, so that the entire power plant may be removed in the event of need. The forward springs are 42 inches length and 2.25 inches width, and the rear springs

are 48 inches length and 2.5 inches width, all being semi-elliptic. The front axle is an I section and the rear axle a rectangular forging, both of heavy construction and heat treated. They are fitted with wheels shod with 36 by 3.5-inch tires forward and 36 by four-inch tires rear.

The drive is at the left side through a gear of the worm and nut type with an 18-inch hand wheel. The spark and throttle levers are under the steering wheel. The clutch and service brake are operated by pedals and change gear and emergency brake levers are at the centre, mounted on the transmission gearset case. The service brake is with internal expanding shoes operating within 10-inch drums with 1.75-inch faces on the jackshaft, and emergency brake shoes operate within 16-inch drums on the rear wheels. All brake shoes are faced with anti-friction material.

The motor is governed so that a speed of 16 miles an hour cannot be exceeded unless the seal is broken. The motor speed is 1150 revolutions a minute. The wheelbase is 125 or 145 inches. Grease cups are located wherever there is contact of moving parts and these are easily accessible. Bodies are stocked to meet the requirements of purchasers in different sizes and types suited to the two lengths of chassis.

The Selden plan of selling machines is a departure in the automobile industry, and it is meeting with large success. The Selden Truck Sales Company of Rochester, N. Y., was organized to provide the necessary financial resources to sell the vehicles on a time payment plan. This policy makes it possible for many reputable merchants and manufacturers to purchase who could not conveniently buy when a full cash payment is required upon delivery. This has opened a very large field for the sale of service wagons, for it affords a certain means for many prospective buyers to own machines without having to carry the financial burden that would be entailed by the immediate payment terms by which most wagons are sold. The Selden plan gives the purchaser a year in which to pay for a vehicle.

INTERESTING PEERLESS MACHINE.

Utilized for Transporting Vinegar in Large Quantities and Designed for Quick Service.

The Peerless five-ton truck, made by the Peerless Motor Car Company, Cleveland, O., and owned by Alart & McGuire of New York City, has the appearance of a water wagon. The firm requires in its business a great amount of vinegar, which is shipped to it in tank cars resembling those used to transport oil. The truck is used to carry the vinegar from the railroad yards to the works.

Quick loading is provided for by a centrifugal pump fitted to the vehicle by the firm's engineer. The truck is run alongside a tank car and the right rear wheel is jacked up so that it does not touch the ground. The mechanism of the pump is attached to this wheel by a belt. The hose is sunk in the tank car and the motor started. It turns the rear wheel over rapidly through the differential and 1153 gallons of vinegar, the capacity of the truck's tank, are pumped in 12 minutes.

The wheel is lowered and the load is transported to the works, the entire transaction taking about 20 minutes. At the receiving end the vinegar is run through a hose from the pipe in the bottom of the truck to another which extends from the sidewalk in front of the plant. It averages 45 miles a day and carries five loads of vinegar. The record haul for one week was 26,000 gallons. A float at the front end of the tank shows the height of the level of vinegar at all times.

WITH CONTINENTAL MOTOR.

A. H. Doolittle Leaves Thompson Agency to Take Charge of Advertising Campaign.

Albert H. Doolittle has been appointed advertising manager of the Continental Motor Manufacturing Company, Detroit and Muskegon, Mich., which is to inaugurate an extensive selling campaign. Mr. Doolittle is well known in the industry and goes to the Continental company from the staff of the J. Walter Thompson Advertising Agency of Detroit. It is understood that the Continental business will still be placed through the MacManus Company of Detroit and Toledo, O.

After studying mechanical engineering at Cornell University, Mr. Doolittle became a member of the engineering force of the Pope Manufacturing Company, Hartford, Conn., in 1904, for the experience that branch afforded. Less than a year later he entered the shops of the Electric Vehicle Company of that city for a thorough course in automobile building. There he went through every department of mechanical construction, assembling, testing, repairing, demonstrating, contest driving and selling, becoming assistant manager of the New York branch. In 1909 he made an extended motor tour of Europe, entering six countries and covering over 7000 miles. During this trip he crossed 17 of the highest passes in the Alps in an American car without trouble. He also visited a number of foreign factories and gained an insight into their methods.

Upon his return he entered the employ of the Knox Automobile Company, Springfield, Mass., and in six months became advertising manager. His copy was conceded to be of special value and his publicity stories were widely used. In this manner he was brought to the attention of the Journal Company of Troy, N. Y., where he aided in directing the advertising campaigns of various automobile concerns and became automobile editor of the Carriage Dealers' Journal. While engaged in special work for this company on behalf of a factory at Moline, Ill., he became associated with the Thompson agency.

THE BLAIR DIRECT DRIVEN TRUCKS.

THE Blair Manufacturing Company, Newark, O., which has an eastern office at 293 Northampton street, Boston, Mass., is building four sizes of worm driven wagons and trucks, these being 1.5, 2.5, 3.5 and five-ton capacities. These machines are the development of more than six years' experience and careful observation of the requirements for differing services, and are built to afford long endurance and constant use. The company began with the purpose of constructing vehicles that would be suited for practical transportation, and the designs were worked out with a knowledge of the hard use and excessive strains and stresses that a machine must be subjected to.

In the work a freight vehicle is expected to do, where it must be used with full load capacity as much of the time as is possible, and where the highways and streets cannot be chosen, it is not always practical for the most careful and skillful driver to favor it, and there are times when the greatest power must be exerted in tractive effort. When a vehicle is driven over rough streets and roads with a load the chassis is subjected to constant distortion, and the "weaving" of the frame causes stress that varies greatly. The rigid construction may result in eventual excessive wear, and the yielding design may bring about disalignment and the accompanying consequences.

Three objects were sought by the designer of the Blair machines, the one being the attainment of the highest efficiency from the power plant, the second the application of the driving effort where it would be extremely productive, and the third the protection of the wearing parts. But it was also desirable to have the mechanism of the vehicle in every way accessible, and to simplify the construction so as to minimize the time that would be necessary for making examination, adjustment and restoration. The design was intended for service, and with the realization of the duty probable large factors of safety were allowed, and the materials selected were those that would, because of quality, afford the necessary strength with a minimum of weight.

In the development of the design it was purposed to create what would be a standard, and from this to build in differing capacities, there being no variance save in proportions, each to have the same qualities and characteristics. The original size decided upon was continued for a considerable period before others were built, this being regarded as an experiment and the vehicles were very closely observed.

In the Blair chassis the endeavor has been to minimize the driving stresses and to reduce to the lowest practical point the strains from distortion, and this has been accomplished in a novel manner. The design is not in any sense experimental, for it has been tested for more than six years, and it has proven to be so important a factor that it has been patented. To illustrate the principle it may be well to instance what may be within the experience of many. Those who have ridden a bicycle understand how easily such a machine may be guided by grasping the handlebar close to the head, and how it may be pushed over obstructions of considerable height. Those familiar with boats know that one may be towed and that it will vary in direction according to the length of the tow rope, but it may be pushed along with a boat hook if the hook is forward of the centre of effort, so-called, and that as the hook is carried forward the control becomes more and more certain. If the hook is placed in the extreme bow it is possible to push the boat with the greatest degree of ease.

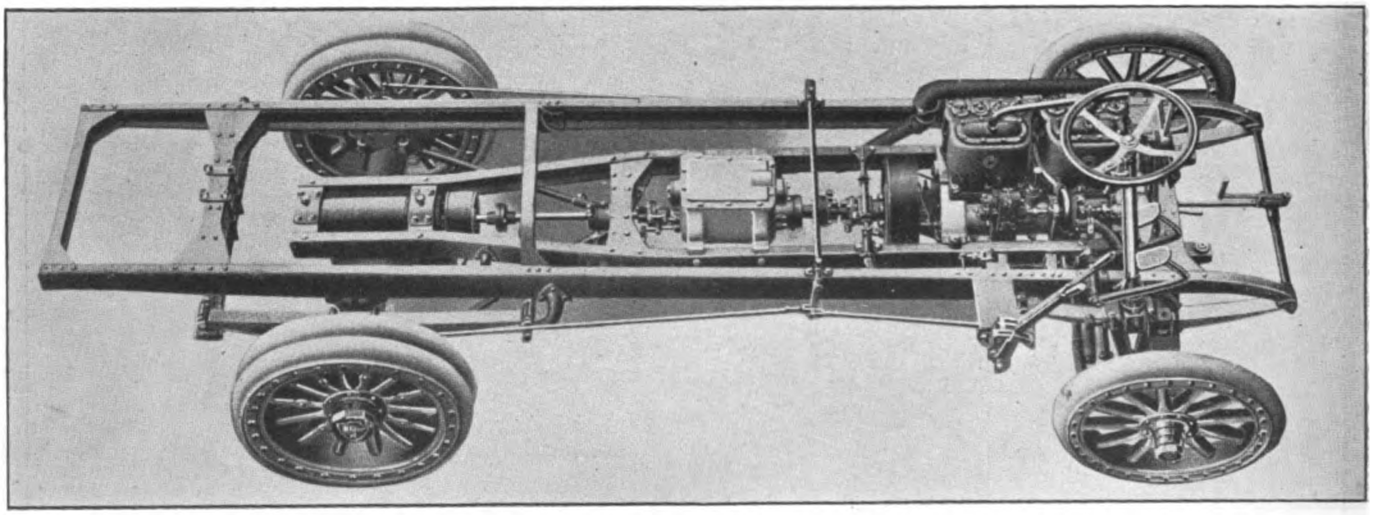
Blair 3000-Pound Direct Driven Delivery Wagon Equipped with an Open Express Body.

The design of the Blair machines is such that the driving effort is exerted directly above the forward axle, and this makes it possible to steer with the greatest ease. The wheels may be placed in a car track, for instance, and the vehicle will follow the track as though the tires were flanged. Instead of the driving thrust being directed upward through radius rods connected to the chassis frame back of the centre, or by a torsion member connected to a chassis cross frame member, in the Blair wagons and trucks the effort is directed in nearly a straight line from the rear axle to the front. This leaves the chassis free to float on the springs, and there is no undue strain brought on the mechanism by the weight of the load.

The result is surprising, because there are no universal joints in the driving shaft, which is carried in a straight line from the clutch to the rear axle, and there is no possibility of side pressure or thrust leverage, because the driving effort is directed through the frame carrying the shaft and mechanism, and it is so installed that the rear axle, no matter what the character of road shock, does not cause a strain. By reference to the chassis illustration it will be seen there is no connection between the chassis frame and the middle or subframe that will not yield to any movement without resistance. The middle frame is slightly longer than the wheelbase of the machine and it is constructed of very large steel channel section. There are four cross members, the one at the front end, the second about two-thirds of the length back, and from this member the frame is "necked" or narrowed with the remaining two members comparatively close to the rear end.

At the forward end of the frame, bolted to the cross member, are two brackets that have heavy yokes, through the arms of which are holes. Bolted to the chassis frame cross member are two brackets with lugs that fit between the yokes, and in which are holes. The brackets are steel castings. Through the holes are large pins of hardened and ground steel. This construction is in effect a hinge or joint, so that the sub-frame is free to move vertically in the joints independently of the chassis frame. The sub-frame carries the motor, which is mounted on side arms, and the transmission gearset case. Between the clutch and the gearset case, transversely on the sub-frame, is the shaft carrying the fork that operates the collar of the clutch. The clutch shaft is coupled to the main shaft of the gearset. The gearset is a selective type, with three forward speeds and reverse, and the case is carried by four arms that rest on the sub-frame. Back of this is the driving shaft, which is in turn coupled to the worm shaft.

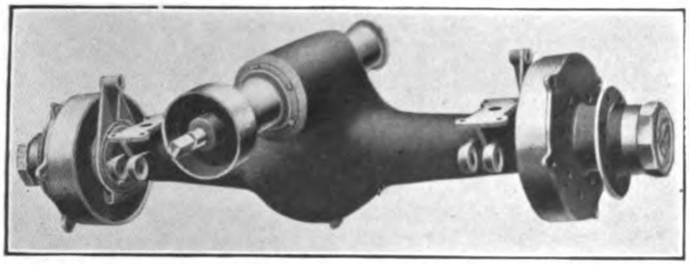
The rear axle housing is a steel casting and reference to an illustration will show its shape. Extending from the front and rear of the worm shaft case are heavy sleeves in which are the shaft bearings, the rear sleeve having a flange at its end. These sleeves are bolted to the axle housing. The worm shaft housing is installed between the ends of the side members of the sub-frame, and two members that are in effect collars are fitted around the sleeves. While the sleeves and collars closely contact, the wide bearing surfaces prevent any movement of the axle save vertically at either end. The collars are mounted on the subframe and it is against them that the driving thrust of the axle is exerted.



Blair 3000-Pound Chassis, Showing the Sub-Frame Carrying the Power Plant and Gearset, and the Means of Drive.

Under the spring seats of the rear axle are yokes into which are fitted the rear ends of distance rods. These rods may be moved vertically. The forward ends are mounted in a member carried in a swivel coupling under the second cross member of the subframe. These rods preserve the relation of the axle with reference to the sub-frame, but they do not resist any movement of the axle in a vertical direction at either end, the sleeves of the axle housing turning within the collars of the sub-frame. The movement of the axle, should either end be lifted by a road obstruction, does not affect the sub-frame, and the radius rods and the collars around the sleeves, while permitting free action, take all of the driving thrust.

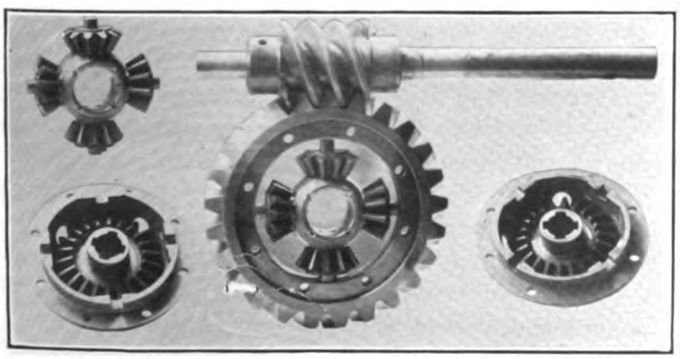
The motors are the well known Continental construction, they being four-cylinder, water-cooled types. These are in different sizes, in every instance there being abundant power. The 1.5-ton chassis has



The Blair Rear Axle Assembly, Illustrating the Rear Support of the Sub-Frame.

an engine with the cylinders cast en bloc with bore of 4.125 inches and stroke of 5.25 inches. The horsepower rating by the S. A. E. standard is 27.25, but it will develop considerably in excess of this. The motors for the 2.5 and 3.5-ton chassis are 4.5 inches bore and 5.5 inches stroke, which are rated by the same formula at 32.4 horsepower. These motors are designed for heavy duty, with a knowledge of the service that is required, and are built of highest quality material. The engines are cooled by a circulation of water driven by a centrifugal pump through a square tube honeycomb type radiator of unusually large size. The capacity of the cooling system is such that without the pump the engine would be kept at a satisfactory temperature under any circumstances by the thermo-syphon circulation.

The lubrication of the motors is by a force feed constant level system. The oil is contained in the base of the crankcase and by double plunger pumps it is forced through tube to the timing gears and the rear main bearing. The excess drains to the bottom of the crank chamber, forming pools into which the crank-pins and the connecting rod ends dip, affording splash lubrication for all other working parts. With these motors the valve mechanism is fully enclosed, and protected. The moving members of the engines are designed with large bearing surfaces and the shafts and gears are of such proportions that long endurance can be expected. The bearings are ample, the timing gears are helical cut to run noiselessly, and the provisions for adjustment include every part subjected to wear. The ignition is by a Bosch dual system, the spark being fixed. This insures a certain efficiency of operation under all conditions, and eliminates all possibility of the motor being abused, because it will pull until it is stopped through the weight of overload. The fuel supply is regulated by the usual hand throttle lever, the only control member on the wheel.



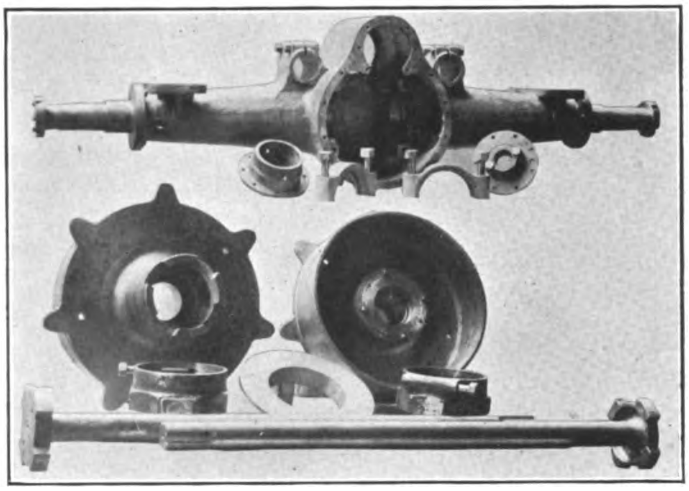
The Blair Worm, Gear Wheel and Differential.

The motor is installed at the forward end of the sub-frame and the flexible connections of the water circulation system provide for any movement of the sub-frame without strain or stress.

The carburetor is a special design of the automatic float feed type and the speed of the machines is regulated by a governor, 14 miles an hour being the limit allowed with the lighter vehicles.

The clutch is a large cone fitted with cork inserts, which insure against uneven or faulty action, and protect the engine against the strains when the machines are working under heavy load. The transmission gearset is mounted practically in the middle of the chassis and is conveniently reached through the opening in the floorboards. The transmission is so designed that all the change speed gears are constantly in mesh, being engaged with jaw clutches, but all the gears are idle when the motor is operated at high speed.

The construction of the rear axle is such that the weight of the car is carried on the ends of the housing, the driving shafts carrying clutches that engage with



The Blair Rear Axle Housing, Differential Bearings, Wheel Hubs and Driving Shafts and Clutches.

the flanges of the wheel hubs. There is no strain on the shafts. The differential gearing is exceedingly simple, the gear being mounted so that it may be adjusted or easily removed. There is a large drum mounted on the driving shaft on which the transmission brake contracts.

The chassis frame is mounted on semi-elliptic springs, the forward set, through which the driving effort is transmitted, being unusually large and strong. The rear springs are a platform construction, shackled forward and rear, so there is no restriction as to the movement of the frame. The front axle is an I section of drop forged steel of large size with unusually sturdy steering knuckles. The spring seats are forged integral. The tiebar and the drag link of the steering gear are located behind the axle to afford full protection against contact with road obstructions. The steering gear is a worm and nut type in which adjustment for lost motion can be made by loosening and tightening a single nut at the head of the housing. The emergency brake operates on drums on the rear wheels

and is a contracting band type. The brake rods, the clutch and transmission linkage are so connected that there is no strain whatever through the movement of the sub-frame.

The dash is installed directly behind the radiator and the engine is covered with a hood that rises above the floorboards back of the radiator. The seats are at either side, that for the driver at the right. The control is by the usual clutch and brake pedals and the levers for the change of gear ratios and the emergency brake are at the right of the driver. This construction makes it possible to examine the motor by lifting the hood without leaving the seats.

The wheel equipment is the usual artillery construction and they are 34 inches diameter with the lightest machine, and 36 inches diameter with the larger. The wheelbase of the 1.5 chassis is 114 inches, and of the 2.5 and 3.5 chassis 121 inches. The tire equipment is 34 by 4 inches single forward for the 1.5-ton type and 34 by 3 inches dual rear; 36 by 4 inches forward and 36 by 3.5 dual rear for the 2.5-ton, and 36 by 5 inches forward and 36 by 4 inches dual rear for the 3.5-ton chassis.

The equipment consists of the oil dash and tail lamps, horn and kit of tools. The chassis are fitted with standard stake platform or panel bodies, or special constructions may be built to meet the particular requirements of the individual purchaser.

NEW LIGHT DELIVERY ATLANTIC ELECTRIC.

THE Atlantic Vehicle Company, which has its executive offices and showrooms at 1600 Broadway, New York City, and its factory at Newark, N. J., has announced the production of the fifth model in the series of Atlantic electric wagons and trucks. The capacity of this machine is 1000 pounds, and is the smallest yet built, the other vehicles being rated at 2000, 4000, 7000 and 10,000 pounds. This model is now offered as a standard of the Atlantic line.

The Atlantic Vehicle Company builds high class vehicles, and it claims for its products extreme efficiency and mileage with reference to battery capacity. The quality of the Atlantic machines with reference to material and workmanship are well known to the service wagon industry and trade. The designs have been standardized and they represent extremely careful study of transportation needs and problems, as well as the best of engineering and the scientific determination of materials and proportions.

The Atlantic vehicles are designed with a view of affording the purchasers long and economical service under normal conditions of operation. While the quality of the materials permits comparatively light weight, there is a very large factor of safety with reference to every wearing part, and there has been extreme care taken to insure simplicity and accessibility that will minimize the labor and economize time so far as the care and attention necessary to efficient maintenance is concerned.

The 2000, 4000, 7000 and 10,000-pound machines are identical in every respect save proportions, the motor being suspended transversely in the frame, and the power being transmitted from the motor to the jackshaft by a single silent chain enclosed in an oil-tight case, and from the jackshaft to sprockets on the rear wheels by chains. The 1000-pound wagon, however, is a different design, the power being applied to a floating rear axle by the motor through reduction gearing, the motor and the axle being assembled practically as a single unit. This construction is considered to be especially simple and practical, affording high efficiency of power transmission and the fullest protection to the working parts, and requiring a minimum of care and attention.

The wagon is designed to have sufficient capacity to meet the requirements of those who desire a fast delivery service, and it has a very large mileage on a single battery charge. The general characteristics of the Atlantic design have been followed with such modifications as were necessary with the changed method of transmitting the power. The motor is a standard series wound construction that is suspended by a band encompassing it that has at either side a trunnion, these trunnions being carried in a yoke bracket that is secured to a cross member. The motor and the rear axle are coupled by a conical steel casting securedly bolted, and within this housing the shaft of the motor and the pinion shaft are connected by a sleeve that is clamped to the pinion shaft, having the necessary clearance for the motor shaft to permit end play and to eliminate the possibility of thrust upon the motor. The relation of the rear axle is preserved by radius rods and the vertical movement of the axle is compensated by the trunnions, on which the motor will move freely. There is no driving strain upon the motor. The lubrication of the axle and motor is provided for in the usual manner. Being in every way protected against the abrasive influences of dust, this construction insures minimized wear and efficient operation.

The other details of the chassis so far as practicable conform to the design of the other models, this being with reference to frame, spring, front axle, wheels and steering gear construction, the same high class materials being used throughout. The frame is a high grade steel channel section with generous cross members, which, with the electric furnace cast steel hangers, are hot riveted. The crucible steel castings conform to the S. A. E. specification; the drop forgings are a carbon steel to the same standard; the hand forgings are a manganese steel and the springs are Krupp silico manganese steel. All of these materials have the recommendation of the Society of Automobile Engineers, and are periodically tested by the Henry South

Engineering Laboratories that the standards shall be maintained. The quality of the steel is insured and such parts as are subjected to stresses are heat treated with extreme care.

The controller lever is mounted on the steering column and is connected with the controller under the toeboards, the controller being easily accessible. The combination service and charging switch is so located that the charging receptacle is dead during the operation of the vehicle. The machine is equipped with two brakes, both operating on the rear wheels, and both being actuated by pedals. The right brake pedal, that controls the service brake, with shoes expanding within large drums, is fitted with a ratchet and pawl for locking the brake. The left pedal operates the external contracting emergency brake bands on the wheel drums.

The battery cradle and compartment is another feature of the chassis. The doors of the box are divided in the centre and are hinged so that each door will swing 90 degrees, forming a shelf at the side when lowered. The battery cradle is mounted on eight travelling rollers that can be moved in guides, so that the trays can be drawn out half their length at either side, there being two stationary rollers on each, which maintain the level of the crates and facilitate handling. Six other rollers are so placed as to prevent the crates wedging in the compartment, insuring easy movement of the trays. This construction minimizes labor in examination of or work on the cells.

The provision made for the lubrication of the moving parts of the chassis is very complete, there being generous grease cups or oilers wherever necessary, and these are always accessible. The equipment of the chassis is complete, with the indicating instruments, switches, charging plug and cable, tools, etc.

ECONOMY IN HAULING MILK.

First Three Months of Service with Saurer Shows Saving of 46.7 Per Cent.

The problem of hauling large quantities of goods within a given time is pointed out as of great importance in the matter of handling perishable food products. The International Motor Company, New York City, has gathered data on the operation of motor trucks in the service of the Wa Wa farms, 18 miles from Philadelphia, Penn. These farms produce 5000 quarts of milk a day, which is delivered to customers in Philadelphia, Atlantic City and other resort towns in New Jersey. On account of its quality a large portion is consumed by babies, small children and persons not in good health. Formerly it was shipped by freight, which necessitated hauling to the local station by means of a three-horse team and again hauling from the Philadelphia milk depot or to Camden for reshipment, as the case might require.

It follows that the practicability of utilizing motor trucks was given careful consideration, and aside from the elimination of numerous handlings, the cost entered largely into the matter. During the first three months the 6.5-ton Saurer was in service it took the milk to West Philadelphia and Camden from the Wa Wa farms, collected the empty bottles and showed a saving of some 46.7 per cent. in haulage charges. Shipping by freight, including the maintenance of two three-horse teams, would have cost as follows: First month, $1078.24; second, $1135.20; third, $1131.87; total for three months, $3345.31. What it actually did cost, using the Saurer, was: First month, $486.01; second, $610.13; third, $686.66; total, $1782.80, representing a saving of $1562.51. The following tabulation is from figures supplied by Manager Stewart of the dairies:

Atlantic Delivery Wagon, One-Ton Capacity, with Panel Body, Used for the Service of A. Silz, Poultry and Game Dealer, New York City.

Truck travels 80 miles a day as follows:

	Miles
One round trip Wa Wa to Camden, N. J., 22 miles each way	44
One round trip Wa Wa to West Philadelphia, 18 miles each way	36
Total	80

Truck hauls 20 tons a day as follows:

Two loads bottled milk from Wa Wa, 6.5 tons each	13
Two loads empty bottles, one way each from Camden and West Philadelphia respectively, 3.5 tons to the load	7
Total	20

Average haul, 20 miles; average load, five tons.

Cost a day of operating, exclusive of depreciation, according to the owner's figures	$19.68
Cost a five-ton load hauled 20 miles	$4.92
Ton-miles a day	400
Cost a ton-mile	4.92c
Depreciation a ton-mile	1.09c
Total cost a ton-mile	6.01c

A reduction of 10 per cent. in the price of Goodyear truck tires was announced April 20 to take effect immediately, this being the second cut since Jan. 1.

The Motor Truck
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. MAY, 1913. NO. 5.

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ADVERTISING RATES.

Information given on request. All advertising copy must reach this office not later than the 25th of the month preceding.

Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

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OVERLOADING THE MOTOR VEHICLE.

Most owners of motor wagons believe they are economists when they overload a machine. Many will unhesitatingly carry as much more than the rated capacity as they can. They know the guarantee often depends upon keeping to the weight limit, they know they are subjecting the tires to excessive strains, they know they are incurring excessive wear, but the supposition is that so long as those who guarantee the machine and its tires do not know, they can abuse the vehicle and claim defect in the event of failure. The purchasers know the capacities of the vehicles, and if the requirements are greater than these it would be far better judgment to buy what will be sufficient to meet them rather than permit what cannot be otherwise than destructive and very expensive. Those who own motor vehicles seldom realize that one overload may badly damage a set of tires, or necessitate costly repairs. It may be accepted for all machines that the makers will establish load maximums that are all that can be carried with safety, and to exceed these is to incur certain expense and deterioration that cannot be anything else than costly.

THE TARIFF PROBLEM.

The provision in the Underwood bill now pending in Congress that will cause revision of the tariff if passed, reducing the import tax on automobile chassis from 45 to 30 per cent. ad valorem, and on finished parts of automobiles from 45 to 20 per cent. ad valorem, has aroused the motor vehicle industry to the most vigorous opposition to the measure. In consideration of the bill the importance of foreign automobiles was given hearing, and this privilege was denied to Americans, whom, it would seem in any sense of justice, should be considered first of all.

The automobile industry of the United States does not represent trusts. Every concern is in active competition with the other. The people have a choice as to the quality and type of machine and the wage earners are the beneficiaries, no matter whether or not the manufacturers themselves make profit. The manufacture of motor vehicles for pleasure has developed some large concerns, but in no instance can it be maintained that growth has been due to the taxation of imported vehicles. The industry today represents an enormous investment, and upon it directly and indirectly hundreds of thousands of people are dependent.

To attain its present proportions—for the production of automobile vehicles is one of the very large industries of the nation—to develop the machines to the highly perfected and efficient vehicles they now are in a very brief time as measured by other industrial progress, has cost enormous sums, and the actual prices charged for American automobiles are really small when the value is measured by the cost of conveyances of similar capacity built even five years ago.

The passage of the tariff bill in the form proposed will certainly benefit no one, and its effect will without doubt react upon the industry. It is too great a factor and too important to be crippled, but a change in the tariff would not mean that the people would get better or cheaper automobiles, and it might lead to such conditions that those who are now dependent upon the industry might be materially affected.

MOTOR HAULAGE AND TAXES.

The endeavors of the legislators of several states has been directed toward the taxation of motorized service wagons, generally with a view of increasing the revenue that can be expended on state highways. With these machines already taxed as property and the owners thus contributing toward the maintenance of roads, to impose a further tax is certain to discourage the use of such vehicles. This is not only a result that will necessarily retard the industry to a material extent, but it means that the public will be denied the advantages of the improved transportation. Speed in business transactions is worth more to the purchasers than the sellers, and to deny the people the benefits to be obtained through the use of motor wagons means that they must be taxed for the more expensive and less satisfactory animal haulage. The assumption may be that the owners of trucks would pay the tax, but in the end it would be the public.

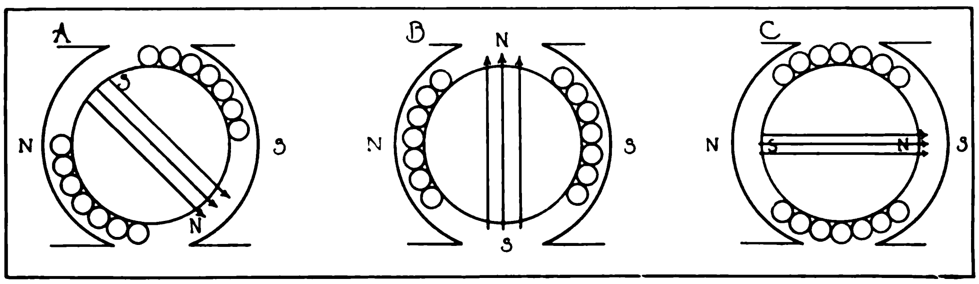
ELECTRIC VEHICLE PRACTISE.

The Transformation of Electric Energy into Mechanical Effort---The Action of the Motor, the Principles of Counter Electromotive Force, Winding Classification, and the Series Wound Construction Used for Vehicles.

By William W. Scott.

IN CONSIDERING the electric motor, it is understood that the pole or field pieces represent north and south poles, between which a magnetic current will flow or is flowing. But the field pieces are not permanent magnets and unless there is residual magnetism, or there is a current of electricity that will excite them, there is practically no flow of energy. When energized the pole pieces create a magnetic field, and it is this field that, acting upon the conductor moving within it, exercises the propulsive effort. The principle is that a conductor carrying an electric current has a tendency to move if placed within a magnetic field.

Were there no conductor there would be an uninterrupted flow of current from the north to the south poles, there being no change in the lines of force. But with the conductor interposed the lines of force passing from the segment forming the north pole to the segment forming the south pole will seek to establish parallelism with the lines of force between the poles of the field magnets. It is practical to describe an electric motor as a construction having a magnetic field, which is produced by field magnets, with conductors in the form of the armature, the armature being so suspended on bearings that it may move when it becomes influenced by the magnetic field.



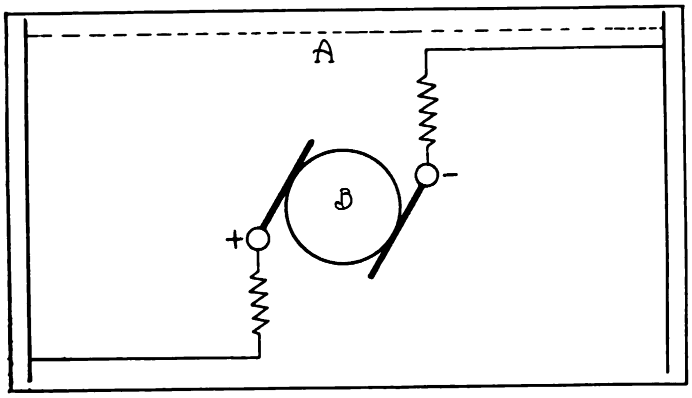
Magnetic Influence in Motor Action: A, Armature at 45 Degree Angle to Lines of Force, Has Greatest Effectiveness; B, Armature Horizontal to Lines of Force Has Least Power; C, Armature Vertical in Lines of Force Has Greatest Resistance.

The creation of a magnetic field within a loop of wire or other conductor, when influenced by an electric current, so that the loop possesses all the qualities of a magnet, is the fundamental principle of dynamos or motors, and it is practical to determine this magnetism with exactness and to anticipate polarity. Each convolution of wire in a winding carrying a given current possesses a definite magneto-motive force, and with the increase of these convolutions the force is increased, the magnetism being forced through the wire. The turns of wire intensify the current, and when they are arranged so that their effect upon each other produces motion the power resultant is proportionate to the magnetic influence caused by the arrangement of the coils and poles, and, of course, the speed of rotation.

When the lines of force of two fields meet and seek to establish parallelism, the arrangement is tangential with reference to the line of one field, and in the case of the electric motor the lines of force pass from the north to the south pole through the armature core. When the armature core is wound with wire it may have a number of positions with reference to the vertical or horizontal plane. To illustrate this it may be well to consider several positions, the first of which may be with the coil in the horizontal plane. This may be noted in the illustration. Assuming that the coil has not influenced the magnetic field, the lines of force pass from the north to the south poles of the magnet, but when the coil is energized by a current it manifests every quality of any electro-magnet despite it being within a magnetic field. The core of the armature is soft iron laminae, and the core is magnetized by the current circulating in the coil. Without the core the magnetic influence of the current would be weak, but with the core it is greatly intensified, and the lines of force of the coil are at right angles with those flowing between the poles. As the poles of the coil will seek the opposite poles of the original magnet, this causes a movement of the coil or armature in the direction governed by the location of the poles created by the ampere-turns of the horizontal coil and those of the field in which the armature core is suspended. As the tendency of the lines of force of the coil is to establish parallelism with the lines of force of the magnetic field motion is created.

But assuming that the coil is in a vertical plane, the magnetic field produced by the coil is at right angles to it, or in a horizontal plane, and these will unite with those of the field of the magnets, but if the poles are opposed the lines of force of the coil will be reduced proportionately to the magneto-motive force. But in this position no motion will be created, as the lines of force will be in parallelism. Between these two extremes another position may be assumed, where the coil and armature is at an angle of 45 degrees with reference to the horizontal and vertical positions assumed, and the magnetic field of the coil is at right

angles to the coil. Here the position of the poles of the coil field is such that movement of the armature must follow, and a strong impulse is manifested, for it



Principle of Counter Electromotive Force: Assumed Difference in Potential Between Terminals 110 Volts; Assumed Counter Electromotive Force 109 Volts; Effective Electromotive Force, One Volt.

is only through moving the coil that the lines of force of the coil can establish parallelism with those of the magnetic field. From this statement it will be noted that slightest variance from the parallel position of the lines of force will impart movement, and it follows that there is a constant tendency of the lines of force of the magnets, which have fixed relation as to influence, and those of the armature coils, to parallel when the latter are in certain position with regard to the magnetic field.

A more simple manner of expression might be to state there are permanent magnets that have generally a uniform influence, and a number of electro-magnets that may be moved, the fields of the latter having a tendency to reach such positions that their lines of force will be parallel with and in the same direction as those of the former. Consequently, as the current is increased, there is attraction of the movable electro-magnets of the armature coils by the permanent magnets of the motor, proportionate to the current. It may be well to instance that the torque of the armature becomes simply a matter of magnetic field and the current in the armature.

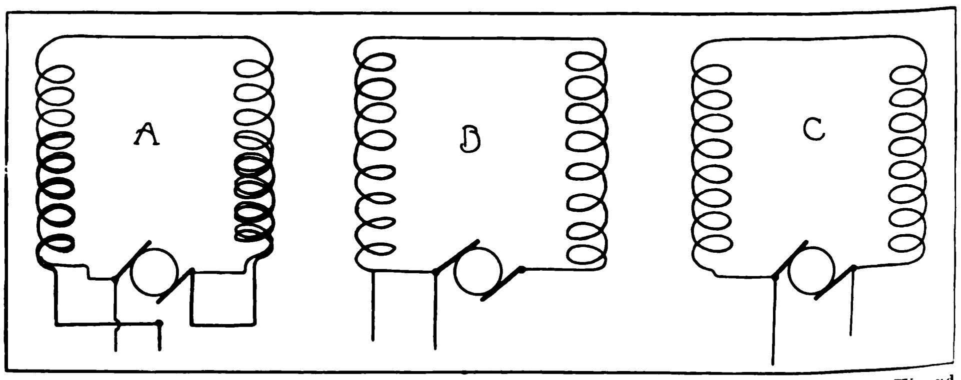
It is possible to very accurately determine the attraction of an electro-magnet and convert it into an expression of mechanical pull or effort, this being a simple equation in which the factors are pull in dynes, line of force a square centimeter, area of the poles in square centimeters, and the circumference, represented by 3.1416.

Reference has been made to counter electromotive force and its influence upon the load upon a motor and the power it will consume. That is, the motor will automatically adjust itself to conditions of use through the counter electromotive force, which moves in the opposite direction to the movement of the armature. This force is created within an armature in precisely the same manner and for the same reason that any other electromotive force is developed by conductors rotating in a magnetic field. Though the motor armature will rotate from the reaction between the field of the magnets and the field of the conductors, the armature has exactly the same influence as free conductors revolving in a field, in that the lines of force are cut and electromotive force is produced. The counter electromotive force may be accurately determined.

In illustrating this the action of a motor armature may be assumed. As current enters the motor the field magnets are energized and this current to a certain degree passes through the armature. The effect of rotating the armature creates an electromotive force within the armature conductors. But there are two electromotive forces active within the armature, one of which sends a current through it, and the other opposes the effect of the entering electromotive force. The electromotive force energizing the motor is known as the line or impressed electromotive force, and the electromotive force generated within the conductors of the armature is known as the counter electromotive force.

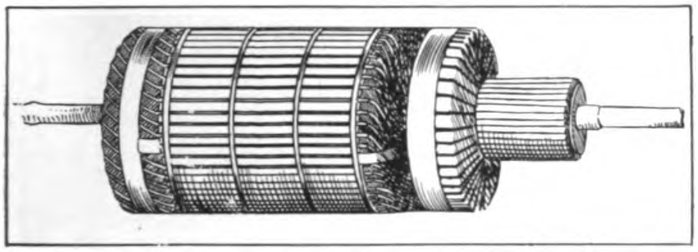
The electromotive force may be varied by conditions with reference to generation, lines of force and conductors, and increase of the number of conductors of a motor armature will create an increased or higher counter electromotive force. If the speed of a motor be changed there will be a corresponding change in the counter electromotive force, while there will be similar change through the variance in the strength of the magnetic field.

The impressed electromotive force is the result of a current sent through the field magnets and causing a field of a definite influence, and through the armature producing a rotative effect and power. A fact that is noteworthy is that when a motor is operated without a load the greatest counter electromotive force is developed, and because of this the current sent through the armature by the impressed electromotive force is at a minimum. The difference between the counter and the impressed electromotive forces is the effective electromotive force. The resistance of the armature governs the current that will be sent through it by the effective electromotive force. This may be illustrated



Examples of Motor Wiring: A, Differential Wound, Constant Potential; B, Shunt Wound, Constant Potential; C, Series Wound, Constant Current.

by assuming that an armature has a resistance of .01 ohm, the impressed electromotive force is 110 volts, and the counter electromotive force is 109.5 volts. The



Series Wound Motor with Resistance in the Circuit, Represented by Rh.

difference between the two is .5 volt, and this would be determined as to current by .5÷.01=50 amperes. This formula may be applied to any resistance and to any voltages, and the result will be the effective current. With low resistance a very small effective pressure will send a heavy current through the armature. In connection with this it should be understood that the changes of the load will vary the motor speed, and it will increase or decrease as the load is increased or decreased. With this variance there is also corresponding change in the counter electromotive force, and the current passing through the armature will vary. The effect of the counter electromotive force is to automatically resist the speed when the motor is driven fast, and its resistance is less when the motor is driven slow.

Motor classification is established by the character of the windings and the form of current by which machines are operated. Motors of the direct current type are differentiated as the constant current series wound, constant potential shunt wound and the constant potential differentially wound. These types are each distinct with reference to windings, but the last mentioned is a combination of the first two. Vehicle motors are generally the series wound machines, which are mainly utilized with direct current circuits or sources of supply whch afford constant current and constant potential. The other types are used for other purposes.

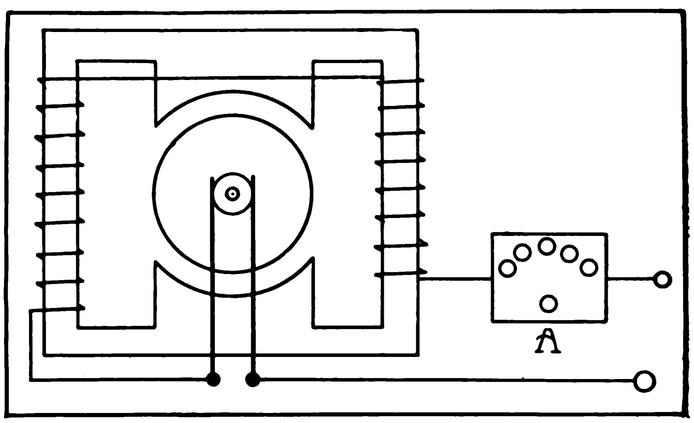
In the design and construction of a motor, speed is a very important factor, and it may be either a constant or variable speed type. It is practical to vary speed, and to control it, by using a resistance in series with a motor, which will govern the voltage and amperage it will receive. But when constant speed is required this may be best obtained by differential winding. The series wound motor will increase in speed as the load is reduced, and will reduce in speed as the load is increased, but the shunt wound motor will maintain a reasonably constant speed when the load is varied. It may be well to define the differentially wound motor as one in which the strength of the magnetic field is variable, so that the strength is the greatest when the load is small, and the field is reduced in strength when the load is heavy.

The series wound motor as developed for motor vehicle service has very long endurance and is regarded as being the most serviceable type. In considering this construction it is well to understand the effect from variable voltage, current and load. The same current is necessary for the field and for the armature, and the machine is very susceptible to the variation of the counter electromotive force of the armature. The current that is passed through the motor may be determined with great accuracy, the current being equal to the difference between the line voltage and the counter electromotive force divided by the resistance through the armature and field in ohms.

It will be understood that as the resistance is increased the current will be lessened, and the current will decrease with the increase of the counter electromotive force. More current will flow as the voltage supplied to the motor is increased, and this will increase the speed of the armature and cause a greater torque or effective movement. The electromotive force is varied by variation of the field strength, and a reduction may be effected by shunting the field winding or short circuiting a part of the lines of force, which lessen the number of lines of force cut by the armature and reduce the counter electromotive force. With the series wound motor no more current can pass in if it is fully loaded and on a constant current circuit, so that there is lessened pull from the diminished field, and speed is reduced.

But a series wound motor must never be operated without load, for the tendency of the machine is to increase its speed to such a velocity that destruction would follow. As applied to the vehicle there is always a load to be carried, and this affords the automatic regulation that follows with work of any character.

The alternating dynamo or motor is built with the windings of the armature connected with the collecting rings, and the direct current machines are constructed with the windings connected with the commutator. In usual practise the armature may be either the drum or ring type, the drum being built on a spindle or sleeve that is carried on a spindle, and the



A Typical Drum Armature and Commutator, Showing the General Characteristics of Construction.

ring being supported by a spider. The drum type is regarded as being a very desirable construction. The drum armature is constructed of a series of circular

plates of soft sheet iron that are insulated by enamel or varnish, the plates being forced into contact to make a solid cylinder. In the peripheries of these plates are notches, and the discs are so placed that when assembled there are channels or grooves extending the length of the armature. The number of channels is carefully determined, for the danger of eddy currents decreases with the increase of the grooves. The production of eddy currents causes heating and perhaps other complications, and it is essential that this danger be minimized so far as possible. The use of the soft iron plates for the core is that there may be a high degree of magnetic permeability, for it is necessary that there be the lowest resistance of the armature to insure the use of minimum current when performing a given work.

Into the grooves in the armature core the windings are laid, with proper insulation, and the power of the motor is dependent upon the character of the windings. The windings are connected with the commutator, and the commutator collects the current produced by the cutting of the magnetic lines of force, so that they may be caused to concur to a desired result. By the commutator an alternating current is transformed to a direct current. Commutators vary in design, but the application is practically the same. A commutator as it is generally built is composed of a series of copper pieces, L shaped, with the longest arm placed longitudinally, or parallel with the armature shaft, and the shorter arm connected with the insulating disc at the end of the armature drum. These segments are separated by insulators that form similar segments, and each piece of copper is a point for connection between two sections of the armature winding. This construction makes possible the collection of the currents induced in the winding at predetermined points. As has been pointed out, while the result from the magnetic induction of the armature windings is the production of an alternating current, there are points at which the induced current will always move in one direction, a condition due to the permanency of the magnetic influence at these points.

These points are defined as the points of commutation, or neutral points, and the points are the locations for the brushes which form the terminals of the outside circuit, that the current sent over that circuit may be perfectly constant. As the armature rotates the brushes bear upon the conducting segment of the commutator at the exact neutral point, which neutral lines are at either extreme of the determined diameter of commutation, and in theory, at least, the diameter is at right angles to the magnetic lines of force, as estimated for a two-pole magnet. The angle, however, is slightly varied by the magnetic lag. As stated, there is excellent reason to have the number of channels carrying the sections of armature winding as numerous as is practical, and the series of segments of the commutator is governed as to number by the character of winding. The greater the number of the collecting members in the commutator the less the fluctuation of the current and the less the possibility of arcing or sparking, but the segments must not be so numerous that brushes of sufficient diameter to carry the current will overlap and burn the armature. The size of the commutator is as important as the number of segments it contains.

(To Be Continued.)

BREWERS ADOPT ELECTRICS.

Five Massachusetts Concerns, Three in Boston, Order General Vehicle Machines.

That five Massachusetts breweries have added electric trucks to their delivery equipments, or have orders placed for machines that will be ready for service within a comparatively short time, is an evidence of the growing utilization of this type of vehicle in New England. One of these concerns is A. J. Houghton & Co., Boston, of the Vienna Brewery, which has just placed a five-ton truck, the second of the kind, in its service. The Massachusetts Breweries Company installed an electric truck a few days ago and will add to this a five-ton truck and a two-ton special delivery wagon, which will be delivered in June and July respectively. The Boylston Brewery, operated by Haffenraffer & Co., has placed in service a five-ton truck equipped with an Edison battery. The Worcester Breweries will take delivery of a two-ton wagon the present month, and the Pittsfield Brewing Association, which has now a one-ton truck in use, has ordered two more. All are General Vehicle machines.

TURNTABLE COMPANY INCORPORATED.

Michigan Concern Secures New Factory and Will Increase Its Scope and Equipment.

The T. C. Beach Auto Turntable Company, St. Johns, Mich., has incorporated with capital stock of $10,000 for the purpose of manufacturing automobile turntables. The incorporators and stockholders are: T. C. Beach, R. S. Clark, W. J. Moss and Robert H. Chapin, all of St. Johns.

The cement factory at the crossing of Lansing street and the Grand Trunk railway has been leased, a provision being included for the purchase of the building later if desired.

The Consumers' Ice Company of Boston, which has established a great artificial ice manufacturing plant at Dorchester, will utilize electric trucks for the haulage of its products, and the first of these will be delivered by the General Vehicle Company, Long Island City, N. Y., in June. The engineers of the company, after considering transportation, decided to use these machines, and the bodies will be from designs by Frank B. Carter. It is a coincidence that the Consumers' Ice Company, Sioux City, Ia., has also just ordered two General Vehicle trucks.

THE PHILADELPHIA THIN PLATE BATTERY.

By James M. Skinner.

THE purpose of the Electric Vehicle Association of America is to promote and stimulate the use of the electric vehicle by educational work. The different sections of the organization endeavor systematically to consider subjects that will be useful to the members in the sale, use and operation of electric machines, and which will especially benefit the owners and operators of such vehicles. Members are invited to present papers on topics of special interest or value, and these are followed by discussions of the different phases that may be developed. As may be assumed, these reviews and analyses of fact are extremely beneficial. The following paper, which will be presented in two parts, was read at a recent meeting of the New York section by James M. Skinner, engineer of the Philadelphia Storage Battery Company, and as it deals with advanced battery cell construction and demonstrates the progression made generally in battery engineering, it has unusual interest, although it is confined to the consideration of the cells made by the company with which Mr. Skinner is associated.

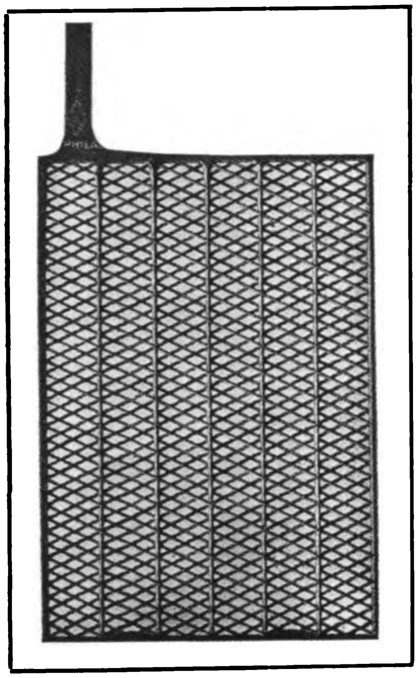


Fig. 1.

The paper is not technical and it can be applied to lead batteries in a general way. The electric storage battery is extremely practical and a great progression has been made in design and efficiency, affording greater mileage capacity and increasing the longevity materially. These facts are established in the following review:

The Philadelphia thin plate battery has now seen six years of service. In spite of the very conservative policy of its manufacturers in exploiting it, it has made good. It is the object of this paper to dig into its characteristics, and to endeavor from a semi-technical standpoint to unearth the reasons for its success. My time is limited. I cannot therefore dwell upon all types of Philadelphia thin plates. Since plates of the W size are manufactured in all of our various thicknesses (W, WM, WT and WTX), I will confine my discussion principally to these, only pausing to state that plates of other areas, such as our CM, CT and R types, are just as much thin plates as our WM, WT and WTX, and embody just the same advantages.

To avoid confusion, in case anyone present does not associate definite thicknesses with the letter names of Philadelphia plates, I may mention that the W plate is .21875 inch thick, the WM .1875, WT .17165, and the WTX .140625. When a new man comes into our laboratory, I try to impress the relative thicknesses upon his mind by telling him that the W is the thick plate; the WM, the medium plate; the M standing for medium; the WT the thin plate, the T meaning thin; and the WTX the extra thin plate, as designated by the TX.

The Diamond Grid.

The WTX is 64 per cent. as thick as the W plate. Possibly your first thought in regard to this statement will be: "Doesn't a 36 per cent. decrease in thickness result in a considerable loss of strength?" I might agree with you that the W plate is stronger than the WTX plate, but I would immediately add that the WTX plate is strong enough, that it, too, contains a large factor of safety. The question of strength was the sticking point which for so many years prevented the employment of thin plates in storage batteries. Until the advent of the diamond grid, no means had been found of securing sufficient strength to make thin plates safe. They would buckle. It was very hard to rid people's minds of that buckling bugbear. Because other thin plates, built on different lines, had been tried, and had buckled, it had become almost a storage battery axiom that buckling was an inherent, incurable thin plate disease. It took several years of non-buckling diamond grids to convince battery users that thin plates did not have to buckle, and even today the same Rip Van Winkle objection is occasionally raised. But such cases are rare. Philadelphia diamond grid thin plates have never been in the habit of buckling, and most battery users have, by personal experience, satisfied themselves that this is the case.

Fig. 1 shows the diamond grid. You can readily understand its strength by considering its construction. Due to the net work of diamond crosses, each part of the plate helps to support every other part. Take the member starting at the lower corner. It runs diagonally across to the other side, then back, and finally across again to the opposite corner. Every other member follows a similar path. A strain on one part of the plate is resisted, not only by the members in the particular region affected, but by the members all through the whole plate. The same idea is used in the arrangement of the members of a bridge truss. It works there and it works in Philadelphia thin plates.

If the diamond grid possessed no other advantage than its great buckling resisting ability, it would still be well worth using. But it does embody other advantages. Notice the arrangement of the members in a double staggered lattice work, with a space between. Notice also that the face of each diamond is backed by a cross, formed by the members of four diamonds on the opposite side of the plate. Every particle of active material is close to a conductor. This is very important. Material far distant from a conductor can never deliver its full quota of energy. Notice further that on each diamond there are four places where members on one face of the plate cross members on the other face. The ability of the diamond grid to lock the active material firmly in place depends on these

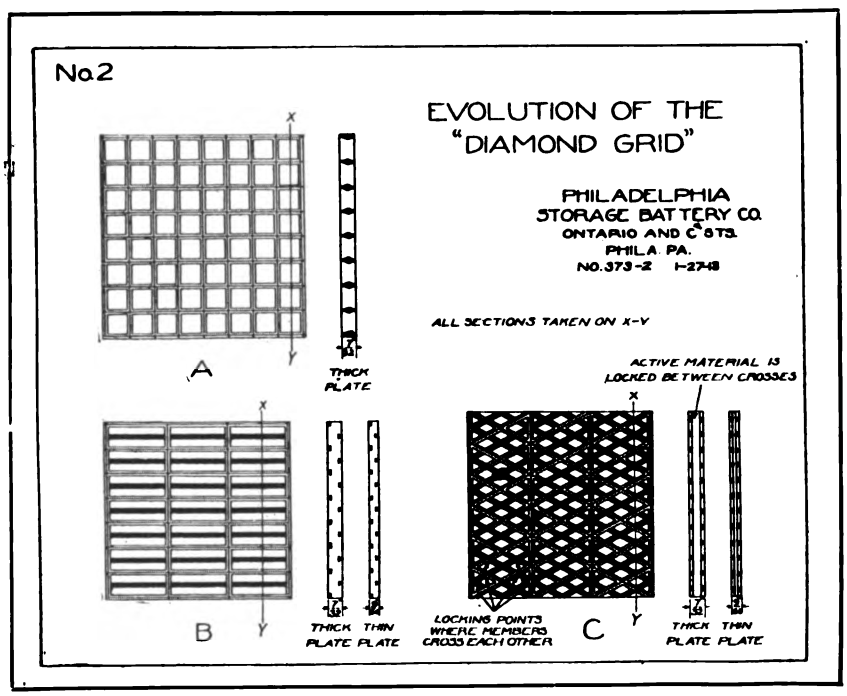


Fig. 2.

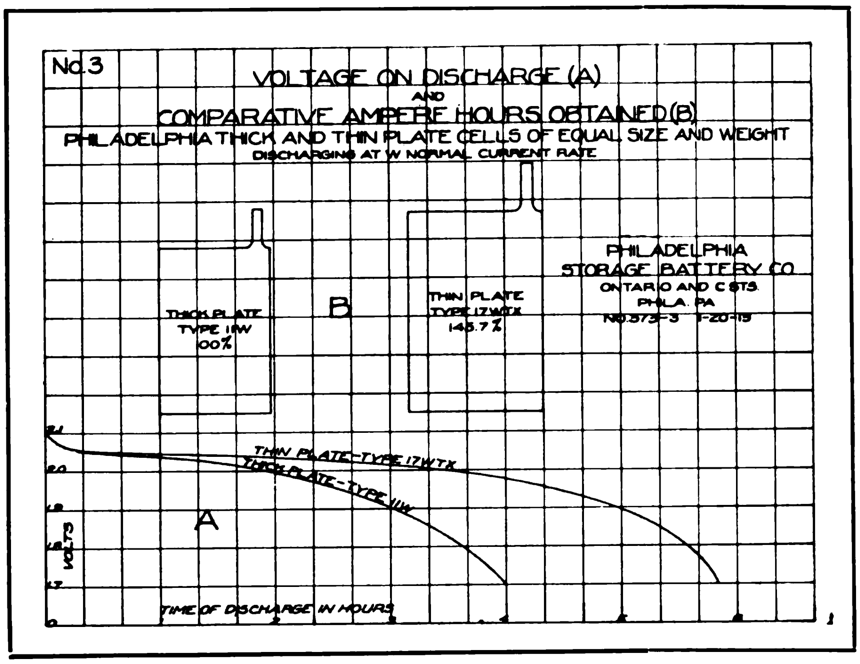


Fig. 3.

crosses. When the material expands, it only presses more tightly upon the grid members. Service jolting cannot dislodge it. It is locked in place. Members that cross each other are an exclusive feature of diamond grids.

Consider for a moment the evolution of the storage battery grid. This is shown in Fig. 2. A shows an early form, merely a single lattice work. Here the material is not locked at all. It is packed in in isolated blocks, which can easily come loose and fall out. B shows a double lattice work grid which, for thick plates, is a distinct improvement on the single lattice. The material is continuous, and offers more or less mutual support. On a thick plate there is some locking, due to the wide space between the lattices, but notice that when the plate is thinned down, it approaches nearer and nearer to the form of the obsolete grid shown in A, and the locking characteristic is practically lost. C shows the diamond grid. Notice the four locking points on each diamond. Notice further that when the plate is thinned down the same locking quality is maintained. The material is bound between the lattices in a thin plate just as firmly as between the lattices in a thick plate. It is interesting to consider buckling resistance here. Notice the diamond grid members are continuous down the plate, not separate as in A and B, and that to bend the plate the resistance of not only the verticals but of the diamond members must be overcome. This figure shows pretty conclusively that the three desirable features for a good thin plate grid, namely, strength, locking ability and conductivity, are all present in the Philadelphia diamond grid.

General Construction.

The Philadelphia thin plate battery is mechanically and chemically correct. Every element entering into its construction is subjected to thorough tests before use. Every process of manufacture is chemically supervised. Plates from every run are tested before the body of the run is O. K.ed for shipment. Extensive laboratories are maintained for these purposes.

In several features the assembling of Philadelphia batteries is unique. The wood separators extend .375 inch above the plates. There can be no short circuits due to bridges over the tops of the separators. The rubber separators are as high as the wood separators, and cannot float up and expose the bottoms of the plates. The wood separators are cut so as to insure mechanical strength. The webs are as thick as the ribs, the spaces between the ribs are only slightly wider than the ribs themselves. Wide solid margins are left unribbed, to give additional strength, to allow for trimming, and to eliminate any chance of short circuits around the edges of the separators. Philadelphia separators do not crush nor split. The initial treatment of the separators is carefully regulated so as to completely remove the impurities without any material reduction in the wood strength. Except in cases of severe ill treatment, happily rare, Philadelphia wood separators usually last the whole life of the battery without renewal.

The batteries are generally assembled in high rib jars with sufficient space beneath the plates to hold all the sediment deposited during the entire life, and cleaning is not required.

Active Material.

The active material in Philadelphia thin plates is of special Philadelphia composition, developed especially for thin plate batteries. This has always been famous for its lasting qualities, and stands with the diamond grid as a large factor in the long life of Philadelphia thin plates. It embodies high coherence and high porosity. The positive material is very slow to soften, and the negative material will not shrink and lose contact with the grid. Philadelphia thin plates maintain high capacity during their entire life.

Mileage and Speed.

The increased mileage of electric cars, due to the substitution of WTX for W batteries of the same weight and size, amounts to about 46 per cent. WT batteries will give 35 per cent. more mileage than W batteries, and WM 20 per cent. more. Fig. 3 shows a discharge, at the same current rate, of W and WTX cells assembled in the same sized jars. The average voltage of the W cell is 1.965 volts, of the WTX, 1.98 volts. Notice how the voltage of the WTX hangs up until almost the end of the discharge. This means sustained car speed.

In service the average voltage of thin plate batteries is often well over two volts, because the full capacity is not usually required every day, and most discharges are not carried down to 1.70 volts a cell. If a WTX battery is only required to give the same number of ampere-hours that a W battery can give, it will finish discharge at about 1.97 volts a cell. The average voltage will then be 2.02 volts.

The speed on any electric car will decrease as the battery discharges, and the voltage across the motor decreases. With lead batteries the percentage variation from the beginning to the end of discharge amounts to about 17 per cent., when the battery is carried down to 1.70 volts a cell. As previously pointed out, the thin plate voltage remains high until almost the end of the discharge. Hence the average speed is only four per cent. below the maximum, even on full discharges. With thin plate batteries discharging to thick plate capacity, the final speed is 96 per cent. and the average speed is 98.4 per cent. of the maximum.

WTX cells contain about 54.5 per cent. more plates than W cells of equal size. This checks rather closely the 46 per cent. capacity increase, and suggests a relation between capacity and the number of plates in a cell. Chemical analysis throws some light on the reason for this. Fig. 4 shows the distribution of discharged active material, that is, lead sulphate, in Philadelphia thick and thin plates, taken from cells discharged to 1.70 volts. These plates were analyzed layer by layer, working in from each side until the centre was reached. The heavier the shading the larger the amount of lead sulphate found. You will note that the discharge is thorough only to a depth of about .03125 inch. The layers deeper than .03125 inch show a rapid decrease in discharged material, until, at the middle of the plate, almost no discharge has taken place. Since it performs so little work it would seem to be good policy to reduce this central core to a minimum. In thin plates it is reduced to a minimum.

It is not the fact that thin plate batteries have greater capacity a plate than thick plate batteries. The capacity a plate is somewhat less, but due to the larger number of plates which can be used, the capacity obtainable from a given sized jar is much greater. A W positive plate will give 28 ampere-hours at the four-hour rate, a WTX positive will give 25.5 ampere-hours at the same current rate. The WTX capacity is 91 per cent. as great, and with only 64 per cent. of the thick-

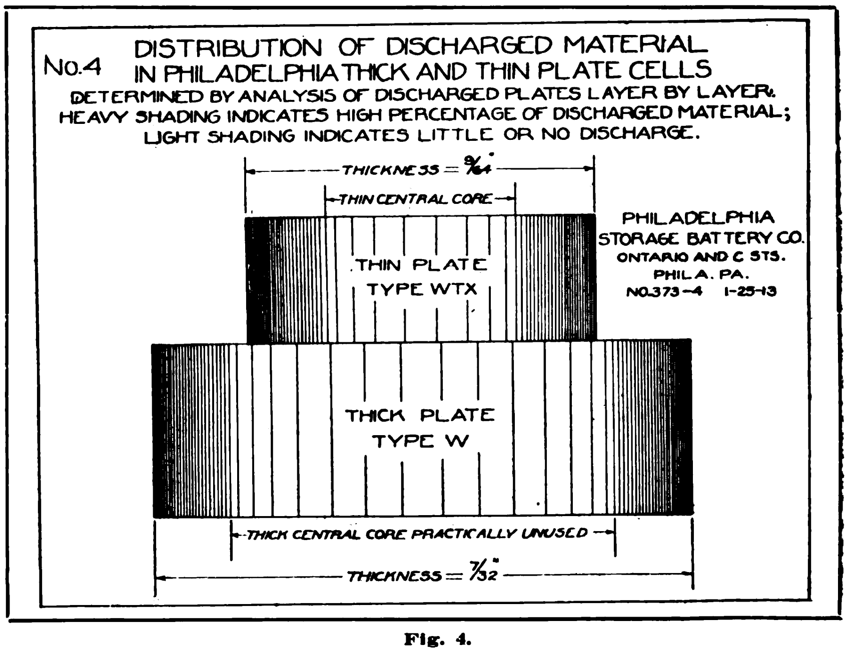


Fig. 4.

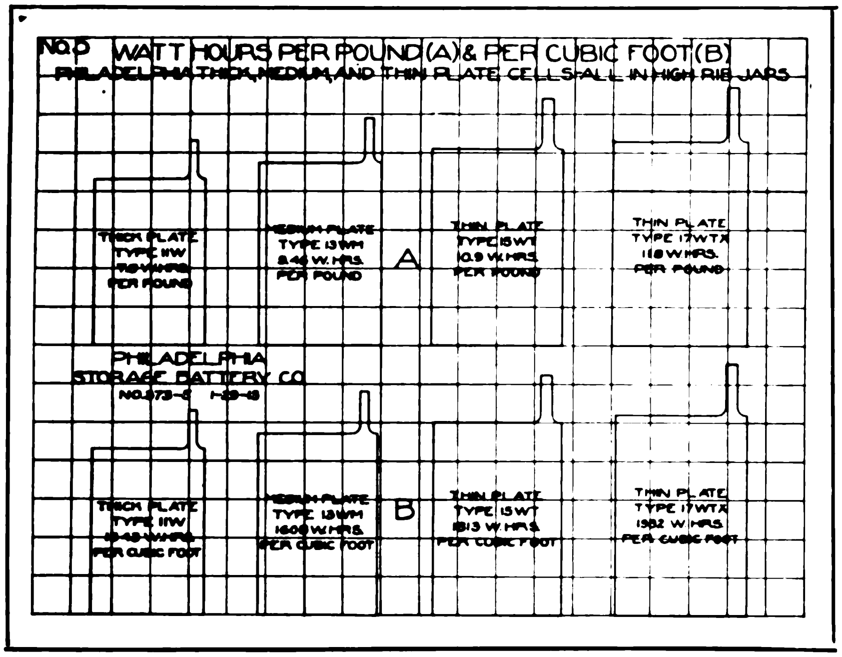


Fig. 5.

ness. In a given jar there can be installed 60 per cent. more WTX positive plates. The relative capacity obtained by substituting thin plates for thick is 160 per cent. multiplied by 91 per cent., or about 146 per cent., as against the thick plate 100 per cent., a 46 per cent. increase, as previously stated.

It has sometimes been assumed that the large central cores in thick plates would result in a better maintenance of capacity when the surface had worn away, and therefore in an increased life. This is not the case. In the first place, as the surface layer of thick plates wears away, they become thin plates. They are not as good as real thin plates, because the material is further away from conductors and cannot as easily deliver its capacity. But assume that the worn thick plates do give as great capacity a plate as thin plates. The battery is then equivalent to a thin plate battery of an equal number of plates, and the capacity is only 91 per cent. of the original thick plate capacity. Moreover the core material is not protected by the rubber separators, and it sloughs off much faster than the surface material. The life after the surface of the plates has worn away is therefore short, and the capacity is below rating. The full capacity of thick plate batteries is not great, and when it falls below rating, the mileage obtainable is usually less than the service demands, and the battery must be scrapped. Even if the low mileage can be utilized for short trips, it can be maintained for only a comparatively few discharges.

On thin plate batteries the material does not wear away as fast as on thick plate batteries. In the first place, the discharges are not carried to such a low voltage, and the material is less loosened up by oversulphation. In the second place, there is less gassing on charge, due to the greater accessibility of the discharged material to the charging current. Gassing is the most damaging factor in shortening battery life. In the third place, there are more plates over which this smaller amount of gas is distributed, and the wear a square inch a charge is less than half as great. In the fourth place, the material in diamond grid thin plates is if anything more firmly locked in position than in diamond grid thick plates. Moreover a great deal of material must be lost before the plates fall below their rated capacity. Philadelphia thin plate batteries maintain full rated capacity until almost the end of their lives.

Weight and Space.

The increased capacity of Philadelphia thin plate batteries is obtained without any increase in weight over thick plate batteries. In fact, a WTX battery is three per cent. lighter than a W battery assembled in WTX high rib jars. The W battery is, however, usually assembled in low rib jars, a distinct disadvantage, because cleaning is required. The WTX battery in its high rib jars weighs just about the same as the W in its low rib jars.

A WTX battery gives about 11.8 watt-hours a pound of cell. It does not seem, however, that this is a matter of any extreme importance. Consider a car, the weight of which without the battery is 8000 pounds. One battery for this car may weigh 2000 pounds, the other 10 per cent. more, or 2200 pounds. With battery No. 1 the car will weigh 10,000 pounds, with battery No. 2, 10,200 pounds. For a 10 per cent. increase in battery weight, there is only a two per cent. increase in car weight. Suppose battery No. 2 costs less, is a better hill climber and gives better speed and quicker starts, has higher efficiency, and gives greater mileage. The two per cent. increase in weight looks very, very small.

Philadelphia WTX batteries will give 1932 watt-hours a cubic foot of cell. This is the highest at present obtainable. Since the battery compartment space on standard cars is limited, the high capacity a unit of volume is a big point in favor of thin plates.

Fig. 5 shows the watt-hours a pound of cell and a cubic foot of cell obtained from various Philadelphia types. Note the steady increase from W to WTX.

Hill Climbing and Acceleration.

A beautiful feature of Philadelphia thin plate batteries is their ability to maintain the speed of the car on hills or on bad roads, and to get the car up to speed quickly on starts. The fundamental reason for this is the extremely large active surface that they present. The number of plates is the biggest factor here, but the diamond grid plays its part by obstructing less of the surface than usual with inactive grid.

Fig. 6 shows the relative plate surface of W and WTX cells in the same sized jars. The WTX shows a 54.5 per cent. increase. This surface is not enclosed by any material obstructing the passage of the acid and current to it. It is all cleared for action. When a battery is called upon to supply a high rate of current, the acid in the electrolyte in immediate contact with the active material is quickly exhausted. If the voltage of the battery and the speed of the car are to be maintained, it is essential that fresh acid from the body of the cell should diffuse to the active material quickly, and this is just what the large surface of Philadelphia thin plate batteries insures.

Thanks to the large plate surface and to the splendid conductivity of sulphuric acid, the internal resistance of Philadelphia thin plate batteries is very low. This is essential for good hill climbing ability. If the internal resistance of a battery is high, it cannot deliver heavy currents without a great fall in voltage, and a corresponding reduction in car speed. A high resistance battery can, of course, be short circuited with less danger, because of the great drop in voltage and the relatively small current that therefore flows. But this is of minor importance. Short circuiting is never required in service, and we can recall no instance of a Philadelphia thin plate battery having been accidentally short circuited to a sufficient extent to cause any damage.

The variation of internal resistance during discharge, in 11 W and 17 WTX cells, is shown in Fig. 7. Notice that the thin plate resistance is considerably less than that of the thick plate, and notice that it keeps low during almost the entire discharge, just as the voltage kept high.

Another result of large plate surface is high average voltage. Fig. 8 shows the average voltage of W and WTX cells, during discharges at various current rates up to six times normal. Notice how the WTX holds up at high rates. It is of the bull dog, stick-to-it nature that won't let go. It is easy to see why Philadelphia thin plate batteries are such good hill climbers, and are so well adapted to the many starts and stops of electric vehicle service.

On this chart have been plotted also curves showing the ampere-hour capacity at various rates of discharge. The ampere-hour capacity here decreases with increasing discharge current. But this is true only of continuous discharges. In

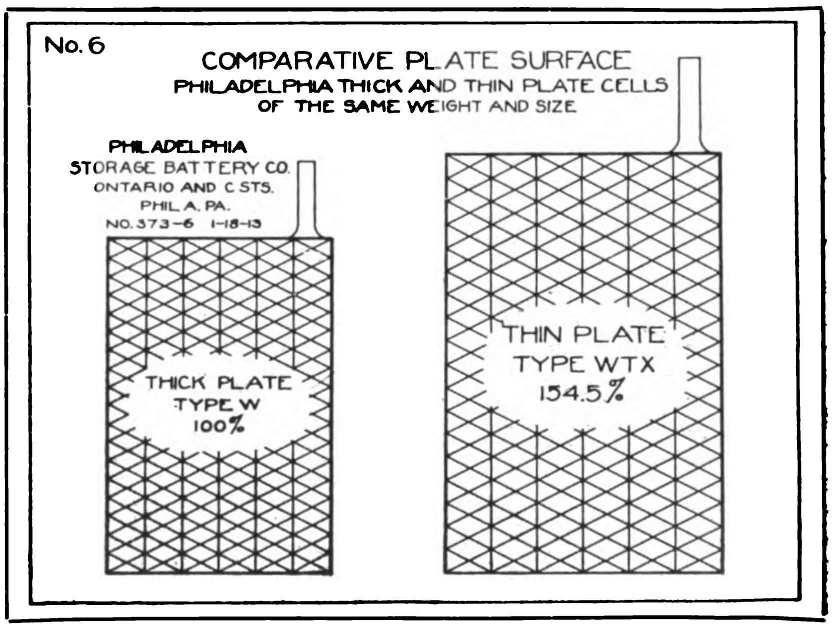


Fig. 6.

service all discharges are intermittent. The factor determining whether more or less than rated ampere-hour capacity will be obtained from a lead battery is the amount of time allowed for fresh acid to diffuse into the plates. A continuous discharge at the three-hour rate allows only three hours for acid diffusion, therefore, fewer than normal ampere-hours are obtained. On the contrary, a discharge at the three-hour current rate, but spread over six hours, allows just as much time for diffusion as a discharge at the six-hour rate, and will give more ampere-hours than the curve shows. In service, discharges often extend over periods of a day or more, and the

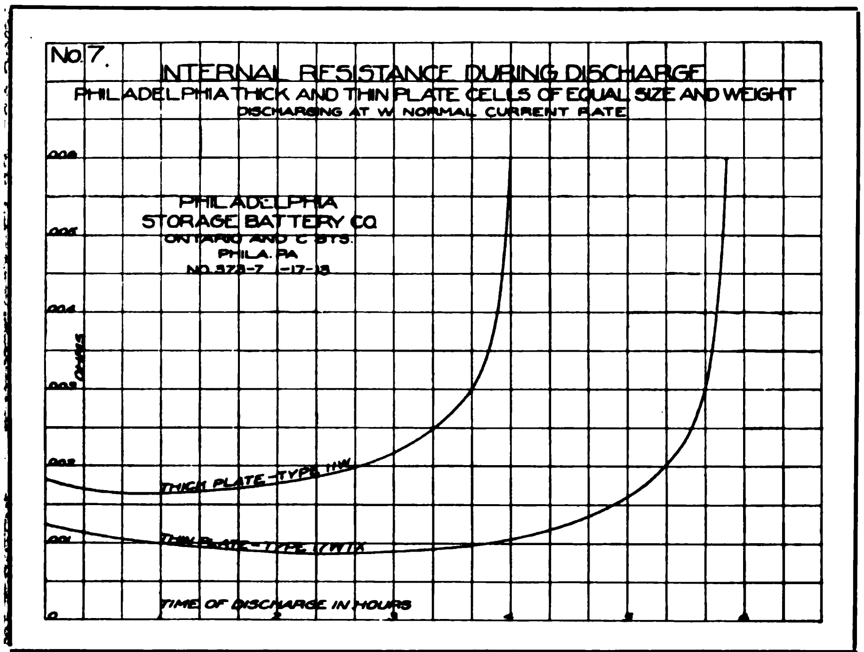


Fig. 7.

ampere-hour capacity of lead batteries may then be considerably over rating. Most electric car service does not call for normal rates of current. Either the car is drawing a high rate, or it is coasting. Thin plate batteries, with their high average voltage and low resistance, are particularly well fitted to meet these conditions.

High average voltage and low internal resistance are advantageous also from the standpoint of ampere-hour consumption. When a given car meets a given grade or a bad stretch of road, a definite tractive effort must be exerted to overcome the resistance. The tractive effort depends upon the torque of the motor. The torque of the motor depends only upon the current supplied to it by the battery, not upon the voltage. To move the car at all, against a given resistance, the motor requires a definite current regardless of the types or size or voltage of the battery which supplies it. But the higher the voltage at which this required current is delivered, the faster the motor will run, and the greater the car speed will be. If the battery voltage is high, the car speed will be high, the car will consume less time a mile, and the number of ampere-hours used a mile will be low. If the battery voltage is low, the speed will be low, the time a mile, and therefore the ampere-hour consumption a mile, will be high. To take a concrete instance, consider two cars, identical as far as make and load are concerned, and containing batteries of equal voltage at normal current draw. Suppose that one battery is of high internal resistance, and that its voltage therefore drops off considerably at high current draws, and that the other battery is of low internal resistance, and that its voltage therefore remains high at high current draws. Assume that a hill one mile long must be climbed, and that the current demanded by the motors, in order that they may exert enough torque to move the cars at all, is 100 amperes. The car with the high resistance battery may run at five miles an hour, or one-fifth of an hour a mile. The low resistance battery may give seven miles an hour, or one-seventh of an hour a mile, due to its higher voltage. The high resistance battery must deliver, on the one mile grade, 100 (amperes) x one-fifth (hours) = 20 ampere-hours; the low resistance battery 100 (amperes) x one-seventh (hours) = 14.3 ampere-hours, a saving of over 25 per cent. in ampere-hour consumption to do the same work, to say nothing of the saving in time. The ground that an ampere-hour of capacity will enable a car to cover varies widely with the type and voltage characteristics of the battery that supplies that ampere-hour.

RECENT PATENTS.

Gear Shift Lever Device, Phares W. Brubaker, West Reading, Penn., No. 1,057,524. A lever working within a slot, one side of said slot being provided with a flexible portion, means for converting said flexible portion into a rigid portion, and means whereby said flexible portion controls the movement of said lever.

Valve Gear, Daniel Appel, East Cleveland, O., No. 1,057,399. In combination with the crankshaft and cylinder of an internal combustion engine, a valve adapted to control, both the inlet and exhaust of gases from the cylinder, a valve rod connected to the valve, and a valve gear comprising a member which has a connection with the valve rod, and means for operating said member so as to impart to the axis of said connection a hypocycloidal path of movement.

Sleeve Type Two-Cycle Engine, Clarence D. Miller, Philadelphia, assignor of one-third to Harry F. Haviland and a like amount to Warren J. Miller of the same city, No. 1,057,442. In an internal combustion engine, a cylinder having in its walls an exhaust port, a sleeve within said cylinder, said sleeve provided with a pair of ports located in different horizontal planes whereby upon the reciprocation of the sleeve in the direction of its axis, the sleeve ports will register successively with the cylinder port, to provide initial and final discharge of the exhaust gases.

Vehicle Wheel, Thomas B. Jeffery, Kenosha, Wis., and Kate E., Charles T. and Harold W. Jeffery, executors, No. 1,056,278. In a vehicle wheel, the combination with the spokes thereof, a two-part spoke head secured to the end of each spoke, flanges on the upper ends of the two parts of each spoke head forming a dovetail channel between the same, a tire rim removably surrounding the spoke heads, dovetail lugs on the inner surface of the tire rim engaging the dovetail channel in the spoke heads and means for forcing the flanges on each spoke head toward each other and against the interposed lug.

Cushion Tired Wheel, Norman Gratz, Boise, Idaho, No. 1,056,167. A wheel tire, comprising an inner rim having radial side flanges, an outer rim composed of segmental sections having inwardly extending side flanges formed with radial slots, means for pressing the outer rim sections outward yieldingly, channelled cross bars secured to the side flanges of the inner rim and extending through the slots in side flanges of the outer rim, rollers carried by the cross bars and arranged in said slots, and with which said channels communicate, a lubricant receptacle and connections between the receptacle and the channel of the cross bars.

Life Saving Apparatus, Clayton E. Frederickson, San Francisco, Cal., and Ivy Baldwin, Alameda, Cal., No. 1,056,271. A portable body catching apparatus, mounted on a motor vehicle, comprising a bed frame, arms rockably mounted at each side of the frame, a crankshaft, devices connecting said shaft to said arms at each side of their fulcrums for swinging said arms inwardly and outwardly in a plane at right angles to the frame, and a flexible body connected to the side arms and adapted to form a net or apron for receiving a falling body thereon.

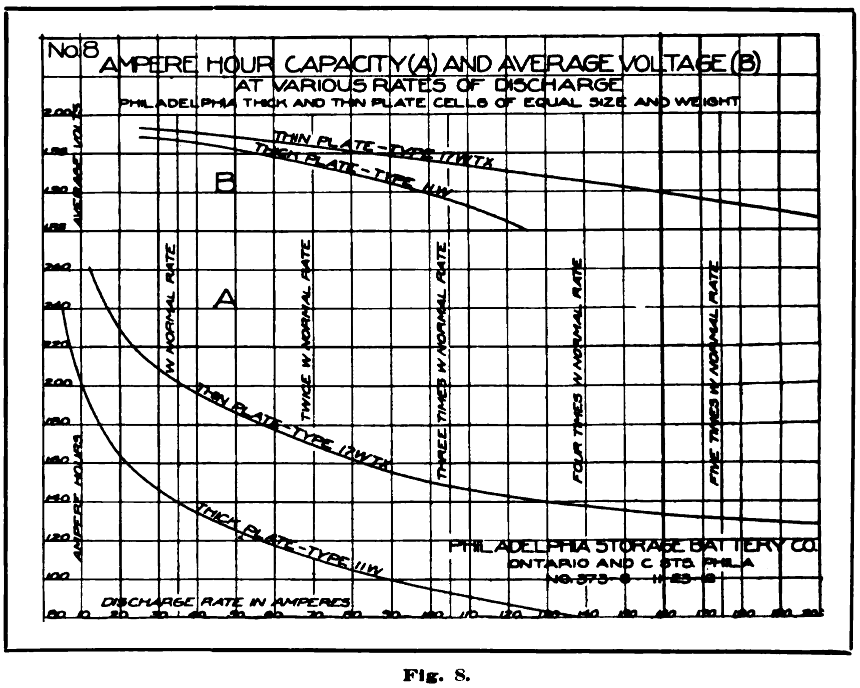


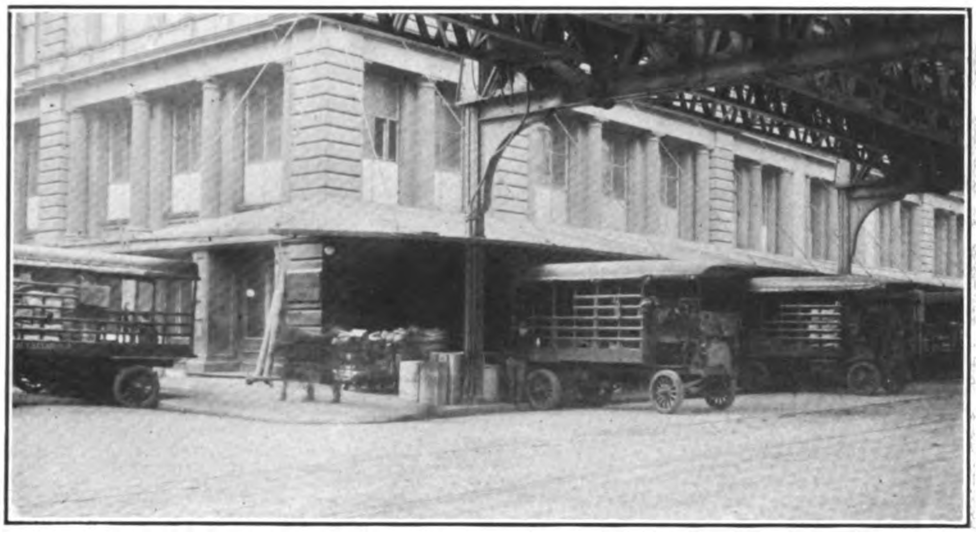
Fig. 8.

WHOLESALE DELIVERY IN NEW YORK.

Metropolitan Distribution of H. B. Claflin & Co., Largest Concern of the Kind in the World, by Motor and Horse Vehicle, the City Being Divided into Districts, Each of Which Is Systematically Served.

DOING a business of approximately $40,000,000 a year and regarded as the largest concern in America, if not in the world, engaged in the distribution of dry goods at wholesale, the house of H. B. Claflin & Co., at Worth street and West Broadway, New York City, maintains a delivery service that is in every way out of the ordinary. This house is known the world over as a wholesaler, but it has the control of 38 large retail houses, which are of the type known as department stores, located in about 34 different cities outside of New York. These stores are supplied to a considerable extent through the New York house, but much of the export trade is supplied by shipments made from Boston, while in many instances goods are sent from the mills, shops and factories direct to the stores. No statement can be made as to the value of the business transacted with retail establishments in New York and its suburbs, but it is very large and can only be measured by millions annually.

The fact that a considerable part of the business transacted is not handled from the New York store is emphasized because of the possible assumption that the delivery system with which this article has to do is sufficient to handle the entire volume of trade represented by the amount stated. In New York the retail stores are Lord & Taylor, James McCreery and O'Neill-Adams. Besides supplying these the company distributes stock to hundreds of stores throughout Greater New York and its suburbs, these being regular and occasional customers.



Loading H. B. Claflin & Co's Trucks at the Shipping Room at Worth Street and West Broadway, the Elevated Tracks Being in the Latter Thoroughfare.

The goods stocked at the store or combined office and warehouse at Worth street and West Broadway, and at the warehouses in Leonard and Hudson streets are received in shipments from all parts of the country and from abroad, and from the city and its suburbs. This means that practically every railroad terminal and nearly all of the docks must be reached by the transportation department, and in some instances the local factories, although most of the New York manufacturers deliver the goods they sell to the company. Besides this the shipments are so widely distributed that it is necessary to send them through at least a majority of the transportation companies.

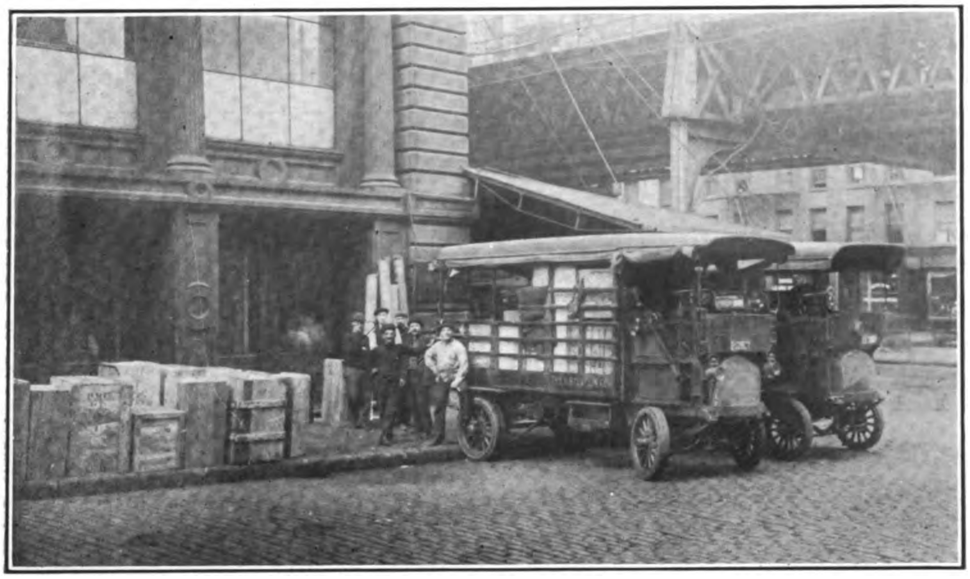
No other business house in New York is required to make use of so many different means of transporting its receipts and shipments, and it is very improbable that there is another that equals it in the number of its city and suburban deliveries. The goods received by the firm are hauled to the main store or the warehouses, oftentimes in large quantities, and stored either in the case or package. More than 100,000 packages are taken from the piers and railroad terminals each year, and these are usually of large size and weight, because the shippers can economize by sending them in the largest single units that can be handled. In addition to these, many thousands of packages are received from local manufacturers during the year.

The main building, which contains the office and a considerable part of the storage space, is a structure of large proportions. The number of people employed in this store is 1800, and while there are many salesmen, the greatest number of employees is engaged in handling the stock. The shipping department is the lower or street floor at the West Broadway end of the building, and in this division are about 200 men and boys who pack and make ready for sending out the cases and packages to be shipped or delivered to customers. At times this number is increased. Besides the force engaged in this work there are others at the different warehouses. It is not possible to average the number of packages sent out daily, because there is so great a variance in demand, but it will be understood that the total is large.

In the section of the city where the store and warehouses are located the traffic is greatly congested from early morning until evening. At the docks and railroad terminals the congestion is probably the greatest

to be found in the metropolis, and this is especially noticeable from 8 in the morning until 6 in the evening. But the street traffic, always dense during the hours stated, is generally dissipated after the close of the working period of the day. Thus during the time when haulage can be done there is probably the largest degree of obstruction to vehicular progress to be observed in America. This fact must be remembered because it has a decided bearing on the expense of distribution, and the progress of transportation is not only retarded by the traffic, but by the regulations that provide for the protection of the people as well as for the use of the streets crossing the main thoroughfares leading north and south.

The shipping department of the company is under the direction of Supt. Hillman, who has been connected with the firm in this capacity for about 30 years, and his knowledge of New York and its highway traffic conditions is probably as broad as any man's in the commercial centre of the nation. For years he did all his work with horses and today utilizes 18 motor vehicles, 12 3.5-ton Vehicle Equipment and General Vehicle electric trucks, one one-ton General Vehicle wagon, and five Mack three-ton gasoline trucks, as well as a considerable number of horse wagons and trucks, these being either two or three-horse teams.



A Corner of the Shipping Room Platform, Showing Two of the Gasoline Trucks Loaded and Ready to Start on the Longer Routes, from Worth Street—All Loading Is Done from the Sidewalk.

In distributing the stock from the store and warehouses it must be remembered that as far north as One Hundred and Twenty-fifth street the traffic during the day is heavy in Manhattan, and as the delivery includes Brooklyn and Jersey City, with more or less congestion of traffic, it will be understood that the speed of the motor vehicle must be governed by the use of the highways. New York street traffic is well regulated and besides the great number of vehicles, in the movement of which the slow retard the fast to a material extent, the swarms of people who must be protected necessitate a much larger part of the delay than is really realized or understood.

Here it might be well to emphasize that for years there has been a gradual increase in cost of metropolitan street transportation despite the endeavors made to improve the conditions through regulation and control, because of the enormous demands for roadway space during the working hours of the day. Not only this, but within the past decade this greater expense has been increased with rapidity that is surprising. This condition will be the better realized when Mr. Hillman's opinion, that for haulage to all parts of Manhattan south of Fifty-ninth street horses are more economical than motor trucks, is stated. This judgment is with a knowledge of the work that can be accomplished with machines and animals, because Mr. Hillman has both in service and has observed them carefully for a period covering about eight years, during which time the motor trucks have been gradually increased. It is necessary, however, to state that this statement is with reference to his own delivery, with units comparatively large, in the heaviest traffic of the continent, and where the conditions for unloading are such as to frequently necessitate delays of considerable length. It is not intended to apply to other deliveries.

In connection with this it is assumed the drivers work as expeditiously as they can and are willing to economize time whenever possible. But all packages must be receipted for, which means that certain men must be found when the deliveries are made, and in some instances collections necessitate loss of time that might be avoided with other service. The loading is accomplished with expedition, but in this work there is no advantage with the motor truck, for the men will require the same time to load any type of vehicle. The freight of a three or 3.5-ton motor truck is about the same as that of a two-horse team and truck, and so far as the Claflin service is concerned the superiority of the power vehicle is its greater speed when the traffic will permit it to be driven faster. When the increased expense of operating the truck is considered Mr. Hillman's statement will be clear and issue will not be taken with it. But the delivery is not the only work that must be done by the transportation department. Practically everything received from the railroads and vessels must be hauled, and a large part of the receipts are from the terminals and docks, where the traffic is the heaviest. A large part of the shipments made is sent to the piers and railroads, but practically all of the railroad companies maintain receiving stations within comparatively short distances of the store and warehouses. In some instances these stations are at

adjacent wharves, where the freight cars are brought on floats and loaded, and in others the shipments are received and transferred by the railroad companies. As all of the railroads have their freight yards outside of the island of Manhattan, and the majority of yards are at Jersey City and Hoboken, these water front receiving stations are a convenience and a great economy to the shippers so far as transportation is concerned.

The weight of the packages for domestic shipment varies widely, but the weights of those made up for export range from 400 to 3000 pounds, and these are sent by automobile truck to the Bush Terminal at Brooklyn or to the Atlas line. The shipments from the Bush Terminal are for South American, Asiatic, California and Hawaiian ports, the last two being via the Tehuantepec railroad from Port of Mexico to Salina Crux. Aside from the export packages practically all of the shipments are delivered to the receiving stations by animal trucks.

In the shipping departments of the store and warehouses the goods are received and packed, and the packages intended for city delivery are prepared with reference to minimized handling. As the orders are made up, sometimes in one case or in several packages, they are verified and checked. Each order is then assigned to a certain route, and the routes as made up include any store within the areas defined as follows:

Downtown route, all of the island of Manhattan south from Worth and Oliver streets to the Battery.

Middle route, from Worth street north to Canal street, and from Center street west to the North river.

Broadway route, that section west of Center street, from Canal to Bleeker streets, bounded on the west by West Broadway.

Lower Sixth avenue route, that section north from Bleeker street to Ninth street, and from Lafayette to West Broadway.

Upper route, that section north of Ninth street to Twenty-third street, and between Fourth and Sixth avenues.

Eighth avenue route, that section north of Canal street to Sixty-second street, west of West Broadway and Sixth avenue.

West Harlem route, the north end of Manhattan from Sixty-second street, west of Eighth and Lenox avenues.

East Harlem route, all that section of Manhattan east of Fifth avenue between Twenty-third street and the Harlem river.

Bronx route, all of the borough of the Bronx.

South Brooklyn route, that section of Brooklyn west of Gold street to Fort Hamilton.

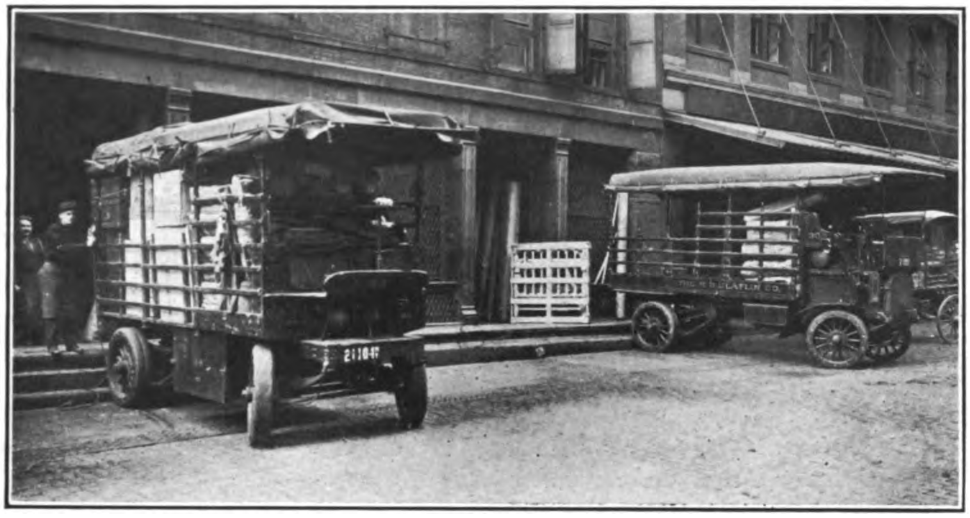
Fulton street route, all that section east of Gold street extending to East New York.

Williamsburg route, that section from the Williamsburg bridge south from Broad street and east of Bedford avenue, out to Ridgewood, east of Graham avenue.

Greenpoint route, that section north of Broadway and west of Graham avenue, out to Newton creek.

In addition to these, deliveries are made at Canarsie, Coney Island, Sheepshead Bay, Jamaica, Richmond Hill, Elmhurst, Astoria and College Point, as well as Staten Island, within the city, and to Jersey City, Hoboken, Newark and even to Hackensack, in New Jersey. The routes, however, are made up to include the customers who must be visited regularly. In some instances the calls are made daily, and with large purchases, several times each day.

The shipping room is a very large department, in which is an office where a clerical force keeps the records of the orders and the deliveries. As the orders are sent to the shipping room office warehouse orders also cause the selection of the stock and when it reaches the shipping force the packages are made up. Each order is first laid out and checked, and when it is packed it is again checked and is placed with the other orders that are to be taken out by a given route vehicle. This route load is accumulated in this manner for each of the routes. It is not possible to determine with accuracy the time when loads will be sent out save in the morning, for the freight of each vehicle will depend upon the size of the orders. In some instances but a few will be carried, and in others a considerable number.



Loading Platform at One of the Leonard Street Warehouses, This Being the Sidewalk at the Front of the Building—These Machines are Loaded for a Regular Morning Route Trip.

The shipping room of the main store frontage is the entire West Broadway end of the building, and it has a series of wide doors for the convenient loading and unloading of the vehicles. Over the sidewalk is a canopy that extends to the curb. The sidewalk is used in one sense as a loading platform, and because

of the requirements of the pedestrians, and that all packages must be lifted, this condition is not as economical as were the shipping from a floor the height of the vehicle bodies and not required for public use. In West Broadway is an elevated railroad and the traffic is heavy, two conditions that make the handling of the machines and wagons slower than were the loading platform on private property. It is necessary to back the vehicles to the curb to load, and of course the expectation is that they will be moved as quickly as possible.

The late afternoon and the early morning orders are expected to give each wagon and truck a load, and between 8:30 and 9 the first loads are made up. The packages are placed in the vehicles in the order of delivery and this necessitates sorting and arranging while loading. The packages are checked as they are loaded and receipted for by the driver, and as delivered they must be signed for, and, if C. O. D., collection must be made as well. The loads are always valuable and in some instances represent large amounts of money. For this reason no driver has a knowledge of the route he shall deliver on until he receives orders to load, and no driver is sent over the same route twice in succession.

There are many reasons for this, but one of these is the possibility of robbery of the wagons or trucks were they to make stated trips and could be followed by men who knew the values of the loads and planned to plunder them. The loss of a single package worth hundreds of dollars might result from theft, and with a knowledge of the possibilities it has been thought wise to make every precaution that would afford protection. The drivers have been in the service of the company for considerable periods and are men worthy of confidence, but it is a lawless element that is found in every large city that the company seeks to guard itself against.

As the routes are laid out the men leave the shipping room and go to the different customers for which they have goods, making the calls in the order assigned, and the loads are made up so that they are delivered without additional handling. Thus the load as it is accumulated in the shipping room is so piled that in loading there is but little sorting necessary, as every package must be checked and accounted for previous to loading. As every delivery must be receipted for by the customer, and if C. O. D., a collection must be made, the driver must have accurate knowledge of his load from the delivery sheet. The loads vary in number of orders and the routes close to the store may be traversed much more often than those at a distance. The uptown routes, however, are with customers greater distances apart and, very generally, the orders are smaller. It naturally takes more time to traverse them.

Below Fifty-ninth street all the delivery is by wagons having capacity of approximately three tons and drawn by teams of two horse, but north of Fifty-ninth street the delivery is by the electrics, within the city, with gasoline truck haulage to Newark, South Brooklyn, the Bronx and to East New York. The first loads are made up in the morning, so that all the drivers of 16 routes are sent away by 9. The men with the longest drives may be gone the greater part of the day, and those on the lower city delivery may be absent but a half day, and possibly less. The shipping orders are made up as received and as the drivers return and report they are sent out for the second and third time, but they do not always have the capacity loads that are made up for the first delivery of the day.

The horse wagons are utilized after the morning routes have been covered for haulage from the piers and shipping terminals, or delivery to them, and in some instances these hauls are but three or four blocks. The sailing times for the water transportation lines are arbitrary so far as the river, sound and coastwise service is concerned, but there is variance with the sailings of the foreign shipping. The shipments to be made by railroad must, however, be delivered prior to stated time to insure acceptance, and to make all the deliveries, as well as the haulage, requires ample leeway, because of the innumerable causes of delay. Where shipments are to be made most frequently there is probability of extreme congestion, and this means that considerable lost time must be anticipated and looked for. Much of the export haulage is to the Bush Terminal and to the Atlas line, and for this work trucks are used.

Besides the delivery there is the haulage from the shipping terminals to the warehouses, and this means the handling of more than 100,000 packages annually. In addition there are the hauls from the local manufacturers. So far as the company is concerned it is rather fortunate in that only one of the piers from which shipments are customarily made exclude gasoline trucks. The electric machines are admitted to all of the piers without question.

In the delivery service of the company each wagon or truck has a driver and a helper, and they do the loading and the handling of the freights carried. They have customs house licenses, so that they may be admitted to the customs houses and to the piers if these are under customs supervision, as well as the bonded warehouses.

The work of the drivers making delivery to the railroad and shipping terminals is governed as well as is possible so far as departures from the store is concerned, but the last trips are more or less dependent upon the delays in the traffic. There is one characteristic of the metropolitan driver that is always manifest—his anxiety to make the last trip as quickly as possible—and with this desire uppermost in the minds of all, as may be assumed, there is an activity near the close of the day that causes traffic maelstroms at the stations and piers, and then comes a hustle through the thoroughfares for the stables or the garages. This means that conditions the latter part of the afternoon are the most unfavorable of the day, and that little useful work can be done after 5. As a rule the drivers

all report at the store and turn in their records and collections.

The city and suburban orders received during the late afternoon are made up and are placed in the shipping room so as to be ready for loading in the morning, for there is no delay in sending the route drivers away and each practically has a load for his vehicle when he reports at the store for the day. The special orders and the work aside from the deliveries are done under the direction of Superintendent Hillman.

The motor vehicles are kept at the big building in East Twenty-ninth street, which was erected as a stable for James McCreery & Co., where the upper floor of the structure is used as a garage. Here also are garaged the machines of James McCreery & Co., which are a one-ton and a two-ton General Vehicle, a three-ton Mack truck, a two-ton and two 1.5-ton Mack delivery wagons, a two-ton Reliance and a one-ton Packard wagon; a three-ton Mack truck and a one-ton General Vehicle delivery wagon of the O'Neill-Adams Company, there being 28 vehicles in all to receive attention. These are all under the supervision of a superintendent whose experience with motor machines covers a period of more than 10 years.

The garage has sufficient machine tools and general equipment to perform all necessary repair work that may ordinarily be required, and attention is given to the vehicles of the three firms as may be necessary. The purpose is to maintain all machines to a standard of efficiency, and while they are worked hard as a rule the withdrawals from service are very infrequent, although all are given overhauls as conditions may require. Careful records of the tires are kept by the wheel system, and the service of the batteries of the electric machines is recorded by mileage. The batteries are rebuilt when reduced capacity entails this work. Practically all of the work necessary on both types of machines is done in the garage, the superintendent having had experience with steam, electric and gasoline vehicles.

ELECTRIC VEHICLE MEN TO MEET.

Convention of Central Station, Manufacturing and Allied Interests at Boston May 20-21.

The first convention of the kind ever held will take place at Boston May 20-21, under the auspices of the New England Section of the Electric Vehicle Association of America, and the Electric Motor Car Club, Boston, this being a gathering of the representatives of the central stations of New England, the electric vehicle manufacturers and allied interests. The purpose of the organizers is to consider means and methods for systematically promoting the use of electric vehicles for both passenger and freight transportation, and the two days will be given over to discussion of differing proposals and suggestions that will, it is believed, be productive of large returns.

Up to the present time there has been no concerted endeavor to stimulate the utilization of electric vehicles, and it is the intention of the committee having charge of the convention to bring together the differing interests with a view of having, so far as this may be practical, a definite plan of campaign and to decide on channels that may be advantageously exploited. The sessions of the convention will take place at the Engineers' building and at the auditorium in the administration building of the Edison Electric Illuminating Company of Boston at 39 Boylston street.

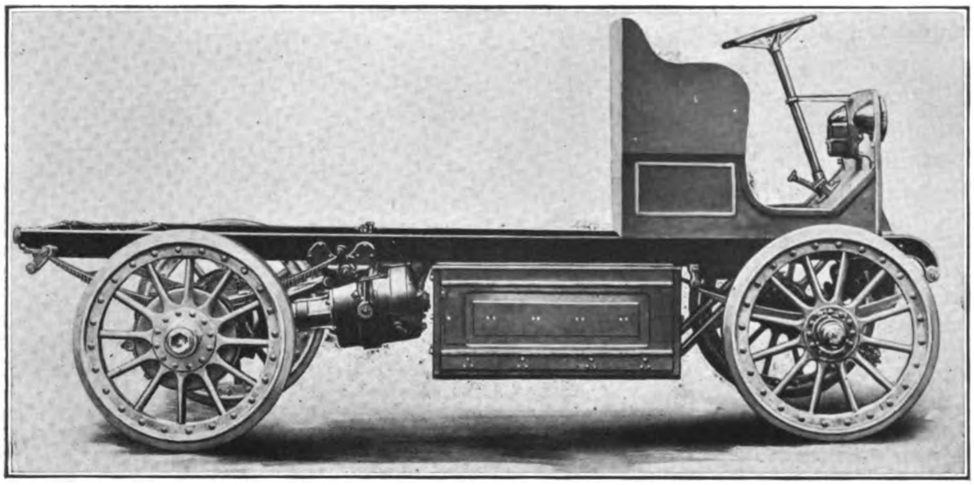
The convention is being arranged by a committee consisting of E. S. Mansfield, vice president of the Electric Vehicle Association of America, chairman; O. G. Draper, secretary of the Electric Motor Car Club of Boston, secretary, and the following general committee, which is grouped by sub-committees: Entertainment, Day Baker, chairman; E. W. M. Bailey of S. R. Bailey & Co., D. C. Tiffany of D. C. Tiffany Company; finance, Fred M. Kimball of the General Electric Company, chairman; Martin S. Fitch of the General Electric Company, J. A. Hunnewell of the Lowell Electric Light Company, S. F. Smith of the Salem Electric Light Company, Albert Weatherby of the Anderson Electric Car Company of Boston; headquarters, L. L. Edgar of the Edison Electric Illuminating Company of Boston, chairman; Robert C. Gregg of the Philadelphia Storage Battery Company of Boston, E. H. Hewin, electric contractor, Boston; invitation and attendance, J. A. White of the United States Light & Heating Company of Boston, chairman; Eugene Carpenter of the Vineyard Lighting Company, F. W. Smith of the Worcester Electric Light Company; parade, F. N. Phelps of the Baker Motor Vehicle Company, chairman; E. H. Dodge of the Dodge Motor Vehicle Company, Boston; H. S. Knowlton of the Electrical World, F. J. Stone of the Electric Storage Battery Company; programme, H. F. Thompson of the Massachusetts Institute of Technology, chairman; E. R. Davenport of the Narragansett Electric Lighting Company of Providence, George W. Holden of the Edison Storage Battery Company, M. T. Sands of the Malden Electric Company and F. D. Stidham of the New England Auto List.

Besides the sessions of the convention it is expected that there will be a parade of electric vehicles of all kinds through some of the principal streets of Boston. Parades of this character had been organized for two years with a large measure of success, but it was believed that it would be best to have the demonstration in connection with the convention. It is expected that a very large number of the owners of machines both in and outside of Boston will allow the participation of the vehicles in the parade, and it is proposed to have this event attract the attention of the public to the very rapid increase of electric cars and wagons in Boston and vicinity. The committee has extended invitations to a large number of people outside of New England and the committee on the convention programme is assured of the attendance of speakers of ability and prominence.

THE BUFFALO ELECTRIC DELIVERY WAGONS.

THE Buffalo delivery wagons, built by the Buffalo Electric Vehicle Company, Buffalo, N. Y., are of two capacities, 1500-2000 and 3500-4000 pounds, and of these the lighter machine is already offered in the market. The other type is practically ready for delivery. The chassis were designed by Guy Vaughan, assisted by H. O. Kemp, now chief engineer for the company. The designs were completed and the first series of machines were well advanced in construction previous to Mr. Vaughan associating himself with the General Motors Company.

The most important feature of the one-ton chassis is the power transmission mechanism, which has been thoroughly developed. The motor is a standard General Electric design, constructed for vehicle service, having a large overload capacity. It is suspended longitudinally from a transverse frame member by two arms, one at either side. The motor shell or housing is encompassed by a phosphor bronze band or strap on which are two trunnions which are fitted to eyes in the ends of the arms, so that the motor may be moved freely on the trunnions. The motor is coupled to the rear axle housing by a heavy webbed tube of large diameter, the assembly being rigid and with the vertical movement of the axle the motor and the shaft enclosed in the tube has a universal action that eliminates all stresses from road shock.



The Chassis of the 1500-2000 Pounds Capacity Buffalo Electric Delivery Wagon.

The armature shaft of the motor carries an external gear that engages with an internal gear on the forward end of the driving shaft, there being a slight longitudinal movement permitted, and this coupling compensates for any variance from true alignment, and besides providing for any possibility of thrust insures the transmission of motor efficiency to the full floating rear axle. The driving shaft is coupled with a double reduction gear in the rear axle housing. The motor and the axles are enclosed in a dust and oil tight casing. The design permits a straight line drive and obviates the need of universal joints, affords the necessary flexibility between the motor and axle, and relieves the members of all stress and strain.

The frame is a pressed steel channel section. 4.5 inches width and of .1875-inch stock, and is assembled with six cross members with ample gusset plates and reinforcement. The frame is 149 inches length and 40 inches width. The forward semi-elliptic springs are 39 inches length and two inches width, and shackled at the rear ends, and the rear springs, of the same type, 48 inches length and 2.5 inches width, are shackled at both ends outside of the frame. The rear axle is fitted with a heavy steel housing and the shafts and wheels are carried on Timken roller bearings. The front axle is an I section steel drop forging and has large spindles and pivots fitted with Timken roller bearings. The steering gear is a worm and sector with an 18-inch hand wheel, and with it the machinery may be turned in a radius of 33 feet. The steering column is braced from the dash to prevent vibration and consequent wear. The wheels are artillery type, of second growth hickory and are shod with 36 by 3.5-inch solid tires forward and rear.

There are two brakes, both operated by pedals, the service brake having shoes that expand within drums bolted to the rear wheels, and the emergency brake having bands that contract upon the same drums. Each shoe or band has an area of 125 square inches, this insuring absolute braking efficiency and a certain control under any circumstances. Both brakes are easily adjusted by wing nuts that are accessible by the removal of the floor boards at the front. The drive from the rear axle is through radius rods that have a swivel connection at the rear, and this eliminates all possibility of driving stress.

The controller is a continuous torque construction, and it is bolted to the frame cross members at the left side, beneath the seat for the driver. No operative parts are exposed to dust, the controller being enclosed in a compartment accessible by a door at the side of the driver's seat. There are five speeds forward and two in reverse. The resistance is a heavy cast grid, insulated with mica.

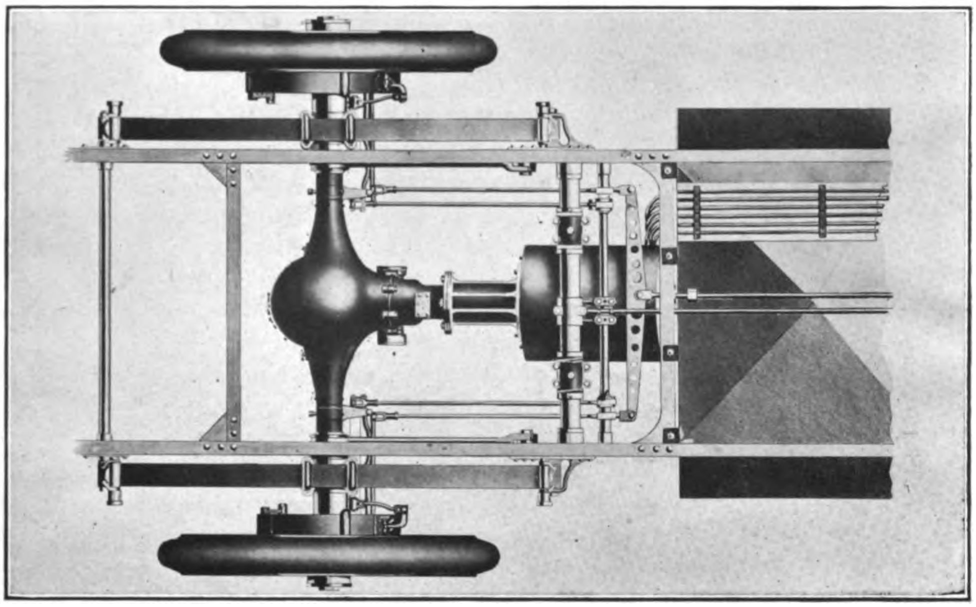
The battery cradle is underslung and it is rigidly braced at the forward end by diagonals to the side members of the frame. The top of the cradle is metal covered to prevent leakage and is pitched to insure drainage and fully protect the battery. The sides drop on hinges to the plane of the bottom of the cradle and are supported by heavy guides at either end. The battery is a 44-cell 13-plate standard Philadelphia, and the crates are set into channels, these being fixed to

the floor of the cradle, while similar channels on the sides permit the crates to be drawn out easily when the sides are lowered for examination or work. The crates are held in the cradle by a rod along the base, and by loosening a few nuts the rod may be taken out and the crates removed, or when replaced they may be secured by tightening the nuts.

The power wiring is standard flexible rubber covered cable of double the normal capacity, covered with wrapping and insulating varnish, and it is carried in a substantial runway and is well secured by separators.

Much care has been taken to insure efficient lubrication and every moving part is provided with an oil or grease cup of such size that there will be ample lubricity for any service that can be undertaken. The wearing parts are large and intended for long endur- while the means for adjustment are extremely accessible and simple. The chassis is so designed that every operating part is assembled with it, and the entire body and the seat for the driver may be removed with no other preparation than the removal of a single bolt and nut connecting the controller arm and the controller handle, and, of course, loosening the bolts retaining the body and seat.

The wheelbase is 102 inches and the tread 58 inches, and the weight of the completed chassis is 3700 pounds. The speed is from eight to 12 miles an hour and the mileage is from 45 to 60 to the battery charge. The chassis is fitted with a safety switch of open spring plunger type and it may be secured against theft by a Yale lock. The charging receptacle is a standard General Electric enclosed concentric contact type with a spring hinged cover. The chassis equipment includes a bell, tail lamp, odometer, charging plug and cable, set of tools and the controller protected by a metal box. The chassis are sold with or without body equipment, the standard body having a length of 100 inches if it extends from the driver's seat to the end of the frame.


The Motor Suspension and Rear Construction of the Buffalo Electric Delivery Wagon, 1500-2000 Pounds Capacity.

ELECTRICS IN MASSACHUSETTS.

First 15 Weeks of the Year Show an Increase of 27.8 Per Cent. Over 1913.

The Electric Motor Car Club of Boston is extremely active in promoting the use and sale of electric vehicles of all types, and has followed the registration of such machines with extreme care. The registration of service vehicles for 1913 for 15 weeks shows an increase of 27.8 per cent. as compared with 1912, the figures being 335 and 262 respectively. It is expected that there will be at least double the number registered this year, because the dealers all have orders for delivery that will very largely swell the total.

There has also been a very large increase in number of pleasure cars, for the total registered for the 15 weeks was equal to that shown by the records of the Massachusetts highway commission to Aug. 15, 1912, and the season for the sale of machines had not begun.

NEW ENGLAND'S LARGEST TRUCK FLEET.

American Express Company Now Installing Thirty Electrics at Boston.

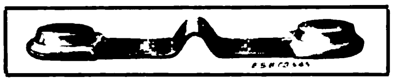
The American Express Company is now installing at its Boston branch the largest single fleet of delivery wagons and trucks owned in New England, and the last of these will be in service before the middle of May. These are all General Vehicle machines and they range in capacity from 1000-pound money collection wagons to 3.5-ton trucks. The majority of them, however, are two-ton vehicles, and will be used for general collection and delivery in the city and its suburbs. All of the fleet is equipped with the new type long distance Edison batteries.

The transformation is going on without interruption of the business of the company in any manner. A section of a large stable building in Congress street has been remodelled and changed to serve as a garage. The delivery could have been made at one time, but the company could not conveniently receive them and the machines were sent in small lots.

The Brown & Sharpe Manufacturing Company, Providence, R. I., which first purchased a General Vehicle truck, and subsequently added to its equipment three more wagons and trucks, has ordered its fifth machine, a two-ton General Vehicle wagon, which is in duplicate of one delivered to it about a year ago.

RECENT LEAD BATTERY DEVELOPMENT.

It is now two years, this month, since before this association, the first public announcement of the "Ironclad-Exide" battery was made, and it is more than two years since the first of these batteries was sold and put into regular work by others than the manufacturer, after nearly four years of development and testing by the latter. The battery was put on regular sale the following January, or the first of the year, 1911. A large demand immediately arose for the new battery, which exceeded the expectations of the manufacturer, and to meet which required increased equipment and overtime work. The immediate result, however, from the prompt installation in regular operation of several hundred sets, was to give an excellent opportunity to study practical results on a large scale, and to obtain quickly data and results, in actual service, equivalent to those of many years of work in laboratory testing. The observation of the operation of many thousand sets of batteries of this type, during the past two years, has resulted in several improvements, some of comparatively minor importance and others of sweeping value to the lead type of battery.



"Ironclad-Exide" Pillar Strap Connector.

Experience is demonstrating that the "Ironclad" construction is prolonging the life of the positive plates to about three times that of the standard flat plate positive. As evidence of this, it may be stated that in all of the several thousand sets of batteries in both commercial and pleasure vehicle service, 999 out of every thousand sets have required no renewal of the positive plates, and no renewals have been made because of any inherent weakness of the plates. This great increase in the strength of what was formerly the weakest link in the chain has brought into focus the limits of durability in other links, and has necessitated improvements in other features of the battery.

It is the purpose of this paper to touch upon some of the more important of these improvements.

The pillar strap connector or connecting link, which has always been supplied with the "Ironclad-Exide" battery, consists of a pair of lead coated copper sheets, or thin straps, upon each end of which is cast a lead alloy head for embracing and "burning" to the pillar terminal. The shrinkage of the casting upon the copper strap gives good contact, and a connector of very low resistance is the result. Complaints were received that some of the earlier batteries appeared to act in a sluggish way as though the internal resistance was high. Investigation of these batteries showed nothing abnormal in that respect until it was finally discovered that the contact between the copper and alloy, although excellent at normal temperature, was sometimes poor when hot. A method was then developed for integrally welding the copper and alloy together, which was at once adopted and which has entirely corrected this trouble.

The type of separator originally used with the first of these batteries was that which had been found so satisfactory in the regular flat plate type, i. e., a piece of vertical grained, specially treated wood. In the ordinary battery it is only necessary to provide a separator which will be sufficiently durable to last during the time when the battery is in operation between cleaning periods. In the "Ironclad-Exide" battery cleaning is practically eliminated; in addition, the life is about three times as long as that of the regular flat plate battery, and the old style of separator proved inadequate to the increased demand upon its life. The vertical grain of the wood, registering in direction with the vertical ribs on the positive plates, eventually caused the wood to split with the grain. The obvious improvement was at once made, which consisted in making the grain of the wood horizontal instead of vertical. An exhaustive investigation had, in the meantime, been started upon the characteristics of different kinds of wood, which resulted in the discovery in certain woods of a power of resisting the action of the electrolyte to a marked degree as compared with the kinds of wood formerly used for the purpose; the difference in durability is not one of minor degree, the life of the wood now used in these cells being several times that of the original kinds of wood.

An important function of the wood separator is to support the active material of the negative plate. Properly supported, as a result of the use of the new separator, the negative plates of the "Ironclad-Exide" battery should outlast the positives.

The problem of separation having been solved, the next feature to become troublesome was the formation of moss growth, which, by bridging across the tops and bottoms of the plates around the edges of the separators, caused partial short circuiting. The insurance against this trouble consists in the incasing of the top and bottom frames of the positive plates in a rubber sheath, which is then vulcanized in position directly to the tubes of which the main body of the

Vertical Grain Wood Separator.

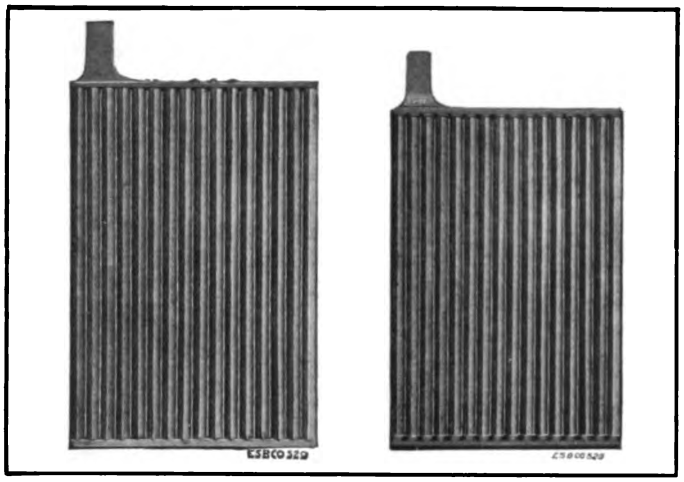
Horizontal Grain Wood Separator.

Abstract of a paper entitled "Some Recent Developments in the Lead Battery for Electric Vehicles," read by Bruce Ford, engineer for the Electric Storage Battery Company, before the Electric Vehicle Association of America, at its third annual convention.

plate consists. With the new positive plate, the exposed portion of which is nothing but rubber, an insulating material, together with the improved porous diaphragm between it and the negative plate, the insulation feature of the "Ironclad-Exide" cell is perfect and something unique.

In assembling the elements in jars there is a tendency for the workmen to drag the vertical edges of the plate along the sharp top edge of the jar. The outside tubes of the original positon plates were not calculated to withstand this particular form of abuse; as now manufactured, the outside tubes of each positive plate are equipped with an unslotted rib of rubber to prevent any breakage at this point.

The only troubles which have developed with the "Ironclad-Exide" battery have been recited above. It is our feeling that the battery, in its present form, is not only free from any troubles due to the plates themselves, but will also be free from short circuits and any necessity for taking apart during its operation, to the end of its useful life. The "Ironclad-Exide" battery



Old Type Ironclad-Exide Positive Plate. New Ironclad-Exide Rubber Sheathing Plate.

will stand up under abusive treatment, which would seriously injure or ruin a flat plate battery.

The improved "Ironclad-Exide" battery puts the electric vehicle in an advanced position. A battery is such a vital part of the equipment that an improvement in the battery becomes a corresponding improvement in the vehicle as a whole, and in the service derived therefrom.

B. Altman & Co., which conducts one of the largest and most progressive department stores in New York, has placed its third order within a year with the General Vehicle Company, Long Island City, N. Y., for electric vehicles, this order being for six 1000-pound delivery wagons, and making the total 15 for the year. It is interesting to note in this connection that this firm has used electric machines for 15 years and was the first to use such a vehicle for service purposes. The initial installation was six 500-pound Riker wagons, several of which are serviceable today. The company's garage, by the way, is one of the best in the world, there being no expense spared in its equipment.

GRINNELL ELECTRIC DELIVERY WAGON.

New Machine with Rated Capacity of 1000 Pounds and Long Battery Mileage.

The Grinnell Electric Car Company, Detroit, Mich., has begun the manufacture of a delivery wagon of 1000 pounds capacity, which is expected to have unusually large battery mileage. Aside from the battery cradle construction the machine is in every way conventional. The motor is a series wound type that is suspended from two transverse frame members, and it is longitudinally driven. The motor is at the right side of the chassis frame and at the left side of the motor is the drive shaft, the first reduction being at the motor. The driving shaft extends from the reduction gearing to the full floating rear axle, there being two universal joints in its length.

The chassis frame is a steel channel section of large size with wide webs, and it is reinforced with cross members and heavy gusset plates. The suspension is on full elliptic springs, 38 inches length and 1.75 inches width. The rear axle is a very substantial member with a housing of pressed steel, with large differential gearing and heavy driving shafts. The forward axle is an I section steel drop forging. The wheels are the artillery type, 34 inches diameter, and these are shod with 43 by four-inch tires. The wheelbase is 96 inches and the tread 56 inches.

The steering gear is an irreversible type with the column placed at the left side and all the parts and linkage are designed for long endurance. The brakes are actuated by pedals, both service and emergency brake being of the internal expanding construction, with shoes operating within drums 14 inches diameter and two inches face bolted to the rear wheels.

The battery cradle is divided, a half being carried at either side, outside of the chassis frame, the boxes being side loading. Each box contains 15 cells of 19 plates each, of the "no wash" type, and it is expected that this will afford working mileage of from 75 to 95 miles to the battery charge. The location of the battery is such that the motor and first reduction gearing is very accessible. The controller is a drum construction and affords five forward speeds of three, five, eight, 12 and 16 miles an hour, and reverse. The bearings are generally of the annular ball type and careful provision has been made for lubricating all wearing parts. The regular equipment includes an amperehour meter, odometer, searchlight in the centre of the dash, side and tail lamps, bell, tool kit, windshield, and, with an enclosed body, a dome light. The bodies supplied are the panel type, 6.5 feet length, three feet nine inches width and four feet eight inches height. The seat is designed for two passengers and the folding "lazy back" has a cross member well upholstered. The machine is known as the "All-Purpose" wagon, and it is designed for all forms of work where large radius of movement and consistent capacity is desired.

HAULING HEAVY LUMBER BY TRACTOR.

Result of Year's Experimentation with Knox-Martin Machine by James A. Potter & Co., Providence, R. I.---Comparison with Horse Drawn Equipment.

BELIEVING that while there are certain classes of haulage for which the horse is and always will be best fitted, a progressive business policy demands careful investigation of modern transportation methods, James A. Potter & Co., Providence, R. I., has been experimenting for the past year with a Knox-Martin tractor, made by the Knox Automobile Company, Springfield, Mass. The results obtained have been such as to indicate that the tractor, like the horse, has its particular field of usefulness, in which the latter cannot compete successfully.

James A. Potter & Co., has been engaged for years in the heavy lumber business, dealing only with the large, heavy timbers utilized in mill and factory construction work, etc. Fifteen years ago these timbers, many of which weigh from one to 1.5 tons, or even more, were hoisted onto running gears drawn by horses solely by manual labor. Both horses and men were worked hard summer and winter and the job was one which was termed "killing work."

This bit of history is recalled in order to show the progress that has been made. In those days labor was comparatively cheap, and horses were considered the only available means of transportation. Perhaps this situation does not differ materially from that in vogue in other lines, but it suggests the slight attention which was given to the matter of efficiency and its application to the problem of economy. The business always had been conducted in this manner and there seemed to be no other method which might be employed.

The question of easy loading was solved first. Huge cranes, operated either by motor or by hand, are now located at all points of vantage in the yards of the company on Crary street. These haul the timbers from the holds of the boats and load them upon running gears to be transported about the yards by horses. They take them from the running gears and pile them in the yard or load them upon railroad cars for shipment to distant points. When the writer visited the plant one of these cranes was unloading a boat from a southern port and loading a Bangor & Aroostook car, which had been shipped from Maine with a cargo of smaller lumber for other concerns in Providence. The interpolation is for the purpose of indicating in a measure the extent of the business done by this concern.

The cranes eliminated much of the laborious work on the part of the men, but it was still necessary to unload the timbers at the point of delivery, reference being had here to the deliveries in the city of Providence and its vicinity, at points to which it would not prove advantageous to ship by railroad or boat. This problem lies not so much in the fact that the work is hard as that it consumes time. However, with the use of horses for hauling, this time factor is not so important in itself, since the horses must be rested at the end of the haul, and often the resting extends over a much longer period than that of unloading, this depending upon the length of the haul.

When it was decided to experiment with the tractor, sufficient information was available to convince the officials of the company that with a motor vehicle maximum efficiency and maximum economy are closely related. Stated in another manner: With horses it is absolutely necessary that there shall be rest periods at certain intervals in order that there shall be proper efficiency, while since the tractor needs no rest, whenever it stops there is loss both in efficiency and economy. This necessitated devising some plan for quick unloading, as well as easy loading.

The inventor of the Knox-Martin tractor anticipated that this machine would be utilized in connection with the regular wagon equipment of the purchaser, and doubtless this plan would prove satisfactory with most lines. It will be seen, however, that the proposition as applied with James A. Potter & Co., was entirely out of the ordinary. This is the point upon which the experimentation has been made rather than with the tractor itself.

When first purchased the tractor was attached to one of the regulation wagons of the company, on which four horses had been employed. This was shod with steel tires all around, so that the only rubber utilized was on the single wheel in front. It is understood, of course, that this is the only wheel on the tractor itself, the rear end of the machine being coupled to the forward wheels of the wagon or trailer, these becoming the traction members.

The ground upon which Crary street yards are located is largely what is known as made land, and the surface has been badly cut up by the heavy haulage thereon for years, so that it is in the form of a powder. Each spring, and after very heavy rain, this powdered soil becomes a veritable quagmire in places, and it was found that the steel shod wheels sank into it to such depth that it was with difficulty that the tractor could haul its load. In this connection it is necessary to state that the machine is capable of handling a load equal to that hauled previously by two four-horse teams.

Because of these extremely heavy loads it was found that the horse wagon was not exactly suited to the requirements, and a contract was let to Jas. Blake & Son, Buffalo, N. Y., for a special wagon. This was of heavier construction throughout and was so built as to carry the load in the most advantageous manner. For instance, the loading space between the wheels is

practically five feet, making it possible to so pile the timbers that greater tonnage can be carried without securing an abnormal height. It was found that it was desirable to provide wheels of comparatively large diameter, because of the necessity for turning the forward, or traction members, under the wagon in making turns on the road, and because it would prove impossible to have the rear members lower than those in front and secure the distribution of the load which was considered proper. Attention also is drawn to the means provided for affording additional protection to the spokes as shown in the accompanying illustration.

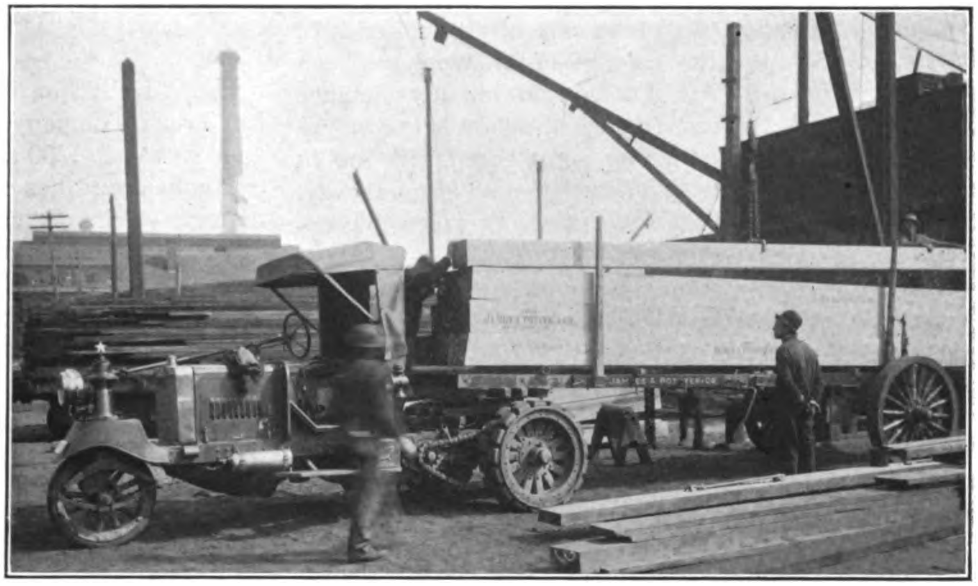
The new wagon also was shod with steel tires all around, the width being six inches. This provided for better traction, but the result was still not just what was desired. Another change was made about three months ago, the traction wheels now being shod with Goodyear block tires. Although they have been run several hundred miles they show no appreciable wear and the officials of the company feel that they have solved this problem satisfactorily. The equipment has yet to find a mud hole from which it has been unable to extricate itself with ease, and it may be added that the driver finds greater comfort in riding.

To return to the matter of unloading: When the new wagon was purchased, A. E. Potter, one of the members of the firm, evolved a plan of utilizing rollers. It will be understood that the loading platform is constructed of metal, with suitable cross frame members. The roller at the rear is provided with a lock which holds it in place, and with a ratchet to which a handle is fixed. The load rests on this roller, but not on the others, which are distributed along the chassis frame, if such it may be termed. When it is desired to unload the timbers, the ratchet handle is operated, the rear roller bringing the load backward until it catches the other rollers in turn and the whole is deposited upon the ground in a pile, as the tractor assists by hauling the wagon out from under it. By this means it is possible to complete the work within 10 minutes.

Mr. Potter says the tractor can do the work of two four-horse teams. This statement needs further amplification. A four-horse team can haul 4000 feet under favorable conditions. This lumber is figured at the rate of 4.5 pounds to the foot, which means that four horses can haul about nine tons. The tractor has hauled 15 tons. It took a load measuring 6875 feet from the yards in Providence to Plainville, Mass., a distance of 20 miles. This figures out at 30,937.5 pounds at 4.5 pounds to the foot. Obviously, there must be some other means of making comparison.

The four-horse team hauls its average load at an average speed of three miles an hour. The tractor travels at between eight and nine miles an hour. If the load is made ready the night previous, four horses can start out at 7 in the morning, go to Attleboro, Mass., a distance of 16 miles, and return to the yard at 6 in the evening. With the tractor it is possible to begin loading in the yard at 1:30 in the afternoon, go to Attleboro and be back in the yard at 5:30. Assuming that two four-horse teams were doing the same work as the tractor, it would take 11 hours to accomplish what the tractor can do in less than four, because with the horses the loading was done the day before.

A sample day's work for the tractor is as follows: Left the yard at 7:20 in the morning, for Lonsdale, R. I., eight miles; returned, eight miles; went to Central Falls, R. I., eight miles; returned, eight miles; went to Woonsocket, R. I., 16 miles; returned, 16 miles; arrived at the yard on the last trip at 5:45 in the afternoon. Thus in 10 hours and 25 minutes, it delivered three loads and covered 64 miles. Of course, time must be taken out for dinner in any case. Two four-horse teams might have made the same mileage, but could not carry the same tonnage.



Illustrating Method of Loading Heavy Lumber by Cranes and the Equipment Used with Knox-Martin Tractor by James A. Potter & Co.

As a matter of fact, there is no basis upon which to formulate an exact comparison, for the reason that the tractor has not been worked steadily. It is used only in what is termed emergency work. Some of the time it has not been available, because of the experimentation which has been made with reference to the wagon. There has been no delay on the part of the tractor itself. Mr. Potter thinks its average daily mileage while in service has been between 30 and 40, but this is due to the manner in which it has been utilized.

It should be stated that all the members of the firm are enthusiastic horsemen. The decision to purchase the tractor was reached only after much discussion,

and then only because it was felt that the demands of modern business were such that provision must be made for the future. The investment, therefore, has been considered in the light of an experiment, and the tractor has not been used when it was deemed practical to work horses. In other words, the horses were considered as a necessary equipment which must be worked to its fullest capacity, and the tractor was held to be available only in emergencies.

By an emergency is meant any haul covering long mileage and extremely heavy loads, any haul where quick delivery is essential, where the roads are not of the best, when the weather conditions are unfavorable for horses, etc. The last named situation is worthy of special mention. With horses, even where the work is confined to the yards, in the heated portion of the summer it is impossible to employ these draft animals steadily. After each short haul it is necessary to take the horse into the shade and apply water to its head and shoulders. The tractor has not been employed to relieve horses in the yard hauls, but in the heat of summer it is expected to take care of all deliveries of any appreciable length. Enough of this work has been done to indicate to Mr. Potter that for any distance inside of a mile the tractor does not show an economy over horses, but beyond that point the figures are in favor of the machine. This applies in a general way, the heated period of the summer being a possible exception.

Because of the manner in which the tractor has been worked there has been no way of determining just what it costs. Roughly, Mr. Potter estimates this at between $12 and $13 a day with an average daily mileage of 40. He says the gasoline consumption figures out at about three miles to the gallon. Two men are employed, not because one could not handle the machine and its load, but because the driver feels the need of an assistant in view of heavy load carried and the unusual features in turning corners, etc. Probably this arrangement will not be continued indefinitely. At present it is an outgrowth of the original plan, when two men were needed to unload the timber before the installation of the rollers. Since it is admitted that but one man is needed, the interests of economy would suggest that it was hardly proper to include the second man's wages in the daily cost estimate.

A comparison of the investment represented by the two equipments is as follows: Tractor, $3250; wagon, $400; extra rubber tires, $400; total, $4050. Eight horses, $2500; two wagons, $300; total, $2800. Beyond stating that in his opinion it costs something less than 60 cents a day to care for a horse, or $4.80 for the eight, Mr. Potter says he has no available figures on the cost of operating horses. The animals, like the tractor, are kept in a building at the yard and no charge is made either for barn rental or garaging. He must have some means for determining to his own satisfaction what it costs to maintain horses, since he otherwise would be unable to make a statement with reference to the relative economy of the two. And he adds that if the firm had work for it to do he would not hesitate to purchase another tractor, albeit he holds that he has not finished his experimentation with the first. He says:

"Most people who attempt to give comparative figures, fail to overlook anything on the horse side of the account, while they may not be so particular about the truck. I would like to give the horse a chance. I believe that the truck has a legitimate place, but I do not believe in trying to make it do a horse's work. It is the same way with this tractor. We don't know just what it can do, but we are safe in saying it can replace two four-horse teams. I believe it has its legitimate place and we are experimenting with it in order to learn just what that is."

MOTOR TRUCK ON THE FARM.

E. S. Kelly Believes It Will Have an Important Bearing in Agriculture in the Future.

E. S. Kelly, president of the Kelly-Springfield Motor Truck Company, Springfield, O., maker of Kelly trucks, has a 1200-acre farm about nine miles from Springfield and has made some study of the utility of motor vehicles in connection with farm work. He comments upon his observation as follows:

"The motor truck will have a great influence in opening up farm land which has hitherto been inaccessible because of its distance from any kind of transportation. There are millions of acres of good farming land in various parts of the country which are lying idle because they are too far away from transportation. A one-ton Kelly truck can cover from 12 to 15 miles an hour, carrying capacity loads over ordinary country roads.

"A team with a heavy load is limited to about six miles an hour or even less. On the whole, a motor truck will cut the time required to carry produce to market to about one-third of what it is with horse drawn vehicles. No one but a farmer who is compelled to make a 20-mile haul to market can appreciate what this means. It will give the farmer far more time to spend on his farm and will effect numerous savings in other ways. The next 20 years will bring about a wonderful development in agriculture and the motor truck will be responsible for a large share of this advance."

The recent motor truck show in Motor Square Garden, Pittsburg, Penn., opened with a huge attendance. One of the largest truck shows ever held in that city was the promise of the promoters and their expectations were more than fulfilled. Among the makes on display were the Dorris, Baker, Locomobile, Packard, Koehler, Pathfinder, Peerless, Pierce-Arrow, Pope-Hartford, Mack, KisselKar, Hewitt, Reo, Speedwell, Shelton, White, Waverley electric, Vulcan and others.

Municipal Service Equipment

SEAGRAVE TYPE D COMBINATION.

An Arrangement That Gives a Complete Fire Department in One Installation.

In an effort to provide an installation that shall give the smaller city or town complete fire protection as well as afford an economical outfit for the larger city, the Seagrave Company, Columbus, O., has introduced its type D combination hose wagon, chemical engine and tractor shown in an accompanying illustration. As may be noted, this not only places at the disposal of the department a rapidly moving vehicle capable of taking care of small fires in their incipiency, but at the same time brings to the scene of the blaze ample equipment to fight the most stubborn fire.

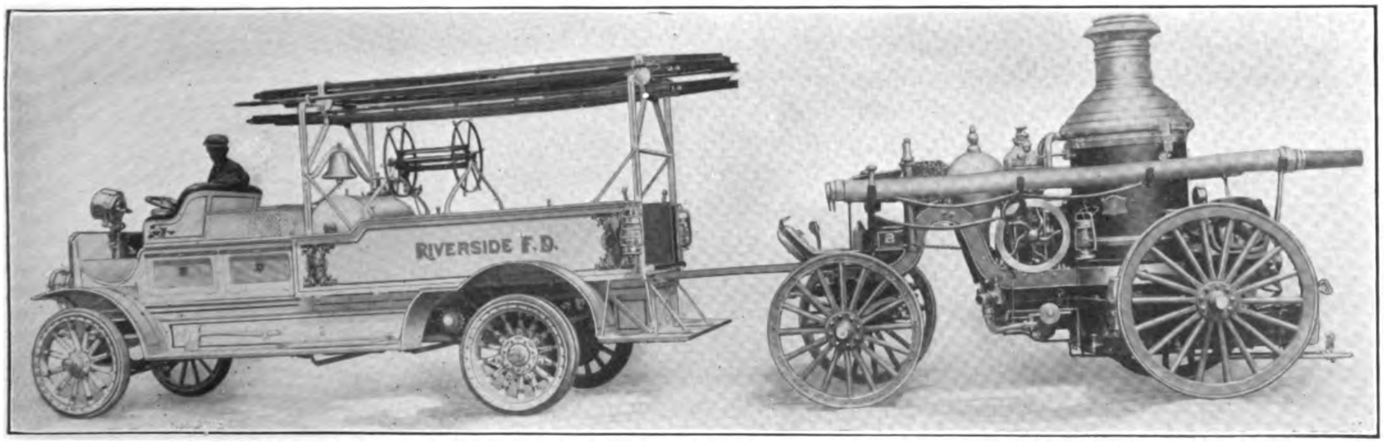
It will be understood that the steam pumping engine is the regulation horse drawn apparatus, which may already be owned by the municipality. The two stand together in the station, a jockey pole on the rear of the tractor being made fast to the splinter bar of the steamer by clamps, and a coupling pin connecting the other end to the power chassis. When a run is made the steamer is dropped off at the hydrant or cistern, and while the hose is being laid from the pumping engine to the fire, the chemical engine is expected to hold the blaze in check or place it under control as it is able.

Considered as a separate piece, the power chassis is equipped with either a four-cylinder 50 horsepower or a six-cylinder 80 horsepower motor. The transmission gives three forward speeds and reverse, and final drive is by double side chains. The wheels are of heavy artillery type with steel hubs, utilizing 36 by four-inch single tires in front and 38 by 2.5-inch dual members in the rear. The wheelbase is 158 inches, tread 62, length over all 20 feet two inches, width six feet six inches, body dimensions, 10 feet by four feet two inches.

The equipment includes a chemical tank of from 20 to 50 gallons capacity, 200 feet of chemical hose, acid bottles, pressure gauge, hose reel, bypass with 2.5-inch hose connection, from 1000 to 2000 feet of regulation fire hose, 12-foot Seagrave trussed roof ladder with folding hooks, 20-foot Seagrave trussed extension ladder with rope hoist, lanterns, axes, crowbar, two three-gallon extinguishers, etc.

The car is built stronger than the standard type and is so constructed that it may withstand the extra duty imposed upon it by hauling the horse drawn equipment. It is maintained by the company that while care must be taken by drivers at first in rounding corners, etc., they soon become accustomed to handling both pieces and corners may be turned at an average speed without difficulty.

Installations of this character are being used successfully in a number of cities, both large and small, and the experience with them is said to have indicated a decided economy. The tractor is expected to displace at least four horses, two for the engine and two for the combination wagon, or if it be one of the larger engines, it will take the place of five horses.



Seagrave Type D Combination Hose Wagon, Chemical Engine and Tractor, as Installed with Horse Drawn Steamer.

EXPERIENCE WITH AUTOMOBILES.

Figures in Watertown, N. Y., Indicate a Saving of Practically $600 in Six Months.

Hundreds of dollars are being saved the taxpayers of Watertown, N. Y., each year by the installation of motor driven apparatus in the fire department. An automobile for Chief Fred Morrison was purchased three years ago and last year a motor combination chemical, hose and pumping engine was added. The latter has more than demonstrated its superiority over the old time fire engine. Following is the cost of the horse drawn and the motor apparatus for six months:

Horse Drawn.	
Maintenance of four horses	$228.00
Wages of two drivers	373.00
Coal for heater	6.00
Repairs, etc	10.00
Total	$617.00
Motor Driven.	
81 gallons gasoline	$11.34
15 gallons oil	5.75
Five pounds transmission grease	.60
Total	$17.69

This is a saving of practically $600 in six months,

Cartercar Pay Car in Service with City Treasurer at Detroit.

or about $1200 a year. The chief's automobile, which has been in constant use nearly every day for three years, having been run 3500 miles up to January, has cost 19.5 cents a day for maintenance. During the past year $56.80 was spent for tubes, patches and replacements of tires; $88.13 for repairs to axle, gas lights, spark plugs, etc.; $38 for repainting.

DETROIT'S PAY CAR SUCCESSFUL.

Plan Found to Make for Economy as Well as Safety in Handling City's Funds.

It will be remembered that the officials of Detroit determined to test out a plan of sending the city paymaster to the various departments and jobs where workmen were employed, instead of sending the money by messenger as previously. It had been found that the messenger was in danger of being attacked and robbed, and it was decided to secure an automobile, specially designed, which should amply protect the funds and those in charge.

The Cartercar Company, Pontiac, Mich., was commissioned to build the car, utilizing plans prepared by the city officials. This machine has now been in service sufficiently long to demonstrate its thorough practicability. It has been found not only to eliminate all risk, but it enables the paymaster to pay off the same number of men in considerably less time. Sixty men were paid in just 10 minutes at the time the accompanying photograph was taken.

FIRE DEPARTMENT ECONOMY.

Pittsburg Man Estimates Entire Equipment Can Be Motorized at 50 Per Cent. Profit.

John H. Dailey, director of the department of public safety of Pittsburg, Penn., is strongly in favor of motorizing municipal fire departments and as a result of his personal experience with the efficiency of motor fire apparatus, he ventures the prediction that within five years there scarcely will be a town of any size in this country in which the major portion of their equipment will not be motorized. Mr. Dailey gives some interesting figures, taken from the experience of the fire department of Pittsburg. He says:

"The actual figures compiled from the operation of what motor apparatus we have show that when we have our department completely motorized we will save the first year almost double what the entire motorization will cost us. It costs approximately $600 a year for each piece to maintain the horse drawn apparatus. On motor propelled fire wagons the cost of maintenance is approximately $55 a year for each piece. This figure is taken from the cost of operation of our chemical and hose wagon at the No. 26 engine house, which is a fairly busy one; more so than the average fire company, so that all around this figure is a fair one on which to base calculations. Included in this cost is the expense for repairs made necessary through two collisions. We operate a total of 131 pieces in our fire department and keep constantly on hand 25 extra horses, which is equivalent to 12 pieces more, making a total of 143 pieces. This does not include the runabouts and horses of the chief engineer and district chiefs. This makes a comparison that looks something like the following:

143 pieces of horse drawn apparatus at $600 a year	$85,800.00
143 pieces of motor propelled apparatus at $55 a year	7,865.00
Balance in favor of motor apparatus, a year	$77,935.00
Add loss through death of horses, etc., about	7,000.00
Total	$84,935.00

"A very large item of economy that must be added to this is that brought about through the reduction of men in the service. This reduction, it should be understood, will not be caused by the discharge of any of those now in the service. The fire department loses every year through various causes such as illness,

death, voluntary resignation because of engaging in other business and retirement on pension, 40 to 50 men. It will take about three years to completely motorize our department, which means we will lose in that time from 120 to 150 men now members of the department. When the latter is completely motorized, with the same number of pieces of apparatus now used, we will need 116 men less, as there are that many who do nothing now but take care of their horses. This reduction in the force will mean an additional saving to the city of approximately $143,000, and this added to the saving in the cost of maintenance makes a total of $227,000.

"When the entire department is motorized we will be able to dispense with about 12 engine houses now in operation without decreasing the efficiency of the department. This, of course, will be made possible by the increased radius of motorized apparatus, amounting to perhaps 300 per cent. The city will have 12 valuable pieces of property for sale and it is fair to assume that we will receive at least $500,000 for all the property sold. Add this to the saving in maintenance and decrease in wages and we have a total of $727,000. The cost of motorizing the department will be approximately $500,000, leaving a net profit of over 50 per cent. on the transaction."

NEWS OF GENERAL INTEREST.

LaFrance in Manchester, N. H.—A new fire truck has been delivered to Manchester, N. H., by the American-LaFrance Fire Engine Company, Elmira, N. Y. The machine carries 250 feet of ladder equipment, 50-gallon chemical tank, two pony extinguishers and general supplies.

Recommends Additional Equipment—Fire Commissioner Charles P. Nutter of Malden, Mass., in his annual report, asks that an appropriation be given for the purchase of more motor fire apparatus and recommends an aerial truck and a pump. It is claimed the apparatus would save the original cost in four years.

Seagrave Proves Satisfactory—Two more automobile hose wagons will probably be ordered by Davenport, Ia., according to an announcement recently made by Fire Chief Denger. It is said that the sentiment of the business men is so strong for additional fire protection that the city council has decided to secure the new machines. The efficiency of the motor tractor on the aerial truck and the hose wagon, made by the Seagrave Company, Columbus, O., has been proven to the satisfaction of Chief Denger.

Four Miles in Ten Minutes—A two-story house just over the state line at Plaistow, N. H., from Haverhill, Mass., was recently burned with a loss of $3000. The town of Plaistow has no fire apparatus and Haverhill was asked for assistance. The automobile truck made the run of four miles in 10 minutes and its arrival was a distinct relief to those who were fighting the flames, having formed a bucket brigade. Although the burning house was doomed before the firemen arrived, the Haverhill men prevented the flames from spreading to other buildings in the town.

Grand Rapids to Buy Vehicles—The officials of Grand Rapids, Mich., have decided to purchase three more motor vehicles; a wagon for the assistant marshal, a supply automobile for superintendent of the fire and police signal systems, and a runabout for the private use of the superintendent. An expert will also be engaged to attend to the mechanical details.

More Apparatus for Springfield—The board of aldermen of Springfield, Mass., has passed an order appropriating $24,000 for the purchase of additional motor apparatus for the fire department. Besides this amount the fire commissioners have $12,000 that was provided for the same purpose in the municipal budget, making $36,000 that will be expended this year. The commission contemplates the purchase of a third electrically propelled aerial ladder truck, a motor pump, a combination hose and chemical truck, and possibly one or two other pieces.

Lynn Department to Be Motorized—That the Lynn fire department, Lynn, Mass., will be equipped entirely with automobile apparatus within two years is the prediction of Commissioner of Buildings H. C. Bayard. The approximate cost of such a change would be $50,000. There are 15 fire stations in the city.

Knox Exceeds Specification Requirements—Stoneham, Mass., has placed in service a new Knox automobile fire truck, made by the Knox Automobile Company, Springfield, Mass. It is equipped with two chemical tanks of 35 gallons each, 1200 feet of hose and 30 feet of ladders. The specifications called for a machine to carry 11 men, but there are accommodations for 20.

Milwaukee Secures Two KisselKars—The city of Milwaukee, Wis., has purchased two additional KisselKar 1500-pound motor wagons for use by its water department. This makes a total of seven KisselKar wagons in the service of that city, four in the water department, two police patrols and a car which does runabout duty for the public library. They were made by the Kissel Motor Car Company, Hartford, Wis.

In the Market—Some of the cities in the market for motor fire apparatus are: Findlay, O.; York, Penn.; Hartford, Conn.; Lynchburg, Va.; Pittsburg, Penn.; Westfield, Mass.; Marshfield, Ore.; Springfield, Ill.; Fond du Lac, Wis.; Pasadena, Cal.; Lawrence, Mass.; Elmira, N. Y.; Joliet, Ill.; Franklin, Penn.; Houston, Tex.; Carlisle, Penn.; Hamilton, O.; Millbury, Mass.; Harrison, N. J.; Troy, N. Y.; Fall River, Mass.; Louisville, Ky.; Anaheim, Cal.

COST ACCOUNTING IMPORTANT.

A Factor That Makes for Elimination of Horses in Favor of Mechanical Transport.

Cost accounting is one of the important factors needed to bring about the absolute elimination of the horse from modern transportation, according to G. W. Bennett, vice president of the Gramm Motor Truck Company, Lima, O., maker of Gramm trucks. "If every man who now uses horses in the delivery of merchandise will keep an accurate account of the cost of his work," says Mr. Bennett, "it will be only a short time before the motor trucks will be adopted to the complete exclusion of animal haulage." He adds:

"The greatest trouble truck salesmen encounter in their work is to convince the man who still sticks to horse and wagon methods of transportation that he is paying an exorbitant price for his service. The percentage of merchants who keep an accurate accounting of their delivery system is very small and it is safe to say that every one who has adopted this businesslike method has forsaken the horse and installed motor trucks. We find this true in our business at any rate. As soon as a Gramm salesman can convince a horse owner that he should figure costs, he is practically certain of making a sale, for invariably he is able to convince the prospect, by the figures already prepared on the prospect's own business, that the motor vehicle will prove an economy in transportation methods. This is especially true in these days of high cost of living, which applies to the maintenance of horses no less than to humans."

KISSELKAR IN MAIL SERVICE.

Works 17 Hours a Day in Collection Department of St. Paul Postoffice.

Following the sale of 15 KisselKar motor wagons, made by the Kissel Motor Car Company, Hartford, Wis., to the United States government for parcel post service after a thorough and severe test at Washington, D. C., the Kissel company has delivered a car of the same model for use in the mail service at St. Paul, Minn. The mail in that city is collected by contract, this relieving the postoffice of the expense of buying and maintaining the equipment necessary to conduct the work. The contractors are held to very rigid terms, penalties being exacted for delays in making scheduled time. For this reason caution was exercised in the selection of a motor wagon, several makes and types being tried out before a decision was reached.

The St. Paul machine is in continual daily use from 8:30 in the morning until 1:30 the following morning. At 8:30 it starts on a tour of the outlying business houses and factories. From 11 in the morning until 7:30 in the evening it tours the downtown districts and from 7:30 until 1:30 it covers the residence sections. Drivers and carriers work in relays.

TRUCKS IN THE PHILIPPINES.

Report of the Public Works Department Indicates Superior Efficiency Under Unfavorable Conditions.

E. Lascaris, New York distributor of De Dion-Bouton trucks, has received an interesting report from the Philippine Islands concerning the performance of certain vehicles purchased by the public works department about three years ago. The report specially bearing on this topic is that of Warwick Greene, director of public works, in which he says:

"During the year this line carried over 19,000 passengers without accident or injury to any of them. Considering the conditions under which this automobile service is maintained, the result is considered remarkable and may be attributed to the strict discipline maintained and to following railroad practise in running the automobiles in trains and regulating the traffic with regular block signal system with gates, gatekeepers and telephones.

"The main reliance of the line is placed on 18 motor trucks, of which 17 were especially built for service on the Benguet road and one for use in Baguio. During the year 5161 tons were carried under the direction of the automobile line, for the greater part by De Dion-Bouton trucks, although a portion was by bull carts and mule teams. Our experience has shown us where considerable saving can be made in operation and there will be a substantial net surplus at the end of the year."

The distance from Camp No. 1 to Baguio is 22 miles and the difference in altitude between Camp No. 1 and Baguio is 5800 feet. It is, therefore, a steady climb over a winding road, and in a tropical climate, which furnishes a severe test of truck efficiency.

NEW YORK'S CLOSED PIERS.

All of the Docks of the Metropolis Except 13 Now Open to Gasoline Trucks.

The most complete information relative to the restrictions with reference to the use of motor vehicles on piers in New York, is to the effect that there are now but 13 lines that refuse to permit access to their terminal to gasoline machines. All of the piers are open to electric vehicles, and those that are closed to other forms are the American Line, Atlantic Transport Line, Anchor Line, Austro-American Line, Cunard Line, French Line, Fabre Line, Hamburg-American Line, Holland-American Line, Italian Royal Mail Line, North German Lloyd, Scandinavian-American Line and White Star Line.

The Atlas Line to Europe and all the Central and South American lines are open, as well as all the river and sound steamer and the railroad piers. This is a very large gain for the gasoline trucks and it is probable that the number of open piers will be materially increased in a comparatively short time.

FOREIGN TRUCK NOTES OF INTEREST

FIRST AID PUMPING ENGINE.

Brief Description of Recent Addition to Fire Fighting Equipment of Paris.

As is more or less well known the fire fighting service in Paris, France, has undergone a complete transformation, automobile apparatus having entirely supplanted horses. It may be added, however, that changes are still taking place, the latest being that of installing what is known as first aid pumping engines. One of these is shown in an accompanying illustration.

The city is divided into 12 sections, each having a barracks and stations, the company of firemen being quartered in the former, while the latter are served by a detachment from the barracks and relieved every 24 hours. The so-called regiment of firemen is under the command of Col. Cordier, who conceived the idea of restricting the larger pumping engines to certain stations and of supplying the others with the first aid apparatus.

These are light vehicles so designed as to reach the scene of the blaze quickly and put out the fire before it has developed serious proportions. The chassis does not differ materially from the usual truck chassis produced by Delahaye. The pump was designed by Farcot. The same four-cylinder motor operates both.

It will be noted that a reel of small hose carrying a nozzle 10 millimeters in diameter is located directly back of the driver's seat in the space sometimes occupied by the chemical hose in the combination wagons in this country, and serving a similar purpose in a measure. This is connected with a reservoir, directly underneath, with a capacity of about 100 gallons of water. The size of the nozzle permits direct attack upon the point where the blaze commences.

When the apparatus reaches the scene of the fire a lever is so placed that the power of the motor is used for driving the pump, which is a multiple-cylinder unit said to have a capacity of 7500 to 8000 gallons an hour. A suction tube is joined to a three-way valve which permits the discharge of the pump into the reservoir, the suction of the pump and pipes from the reservoir, the directing of the pump onto the fire or the filling of the reservoir without the aid of the pump.

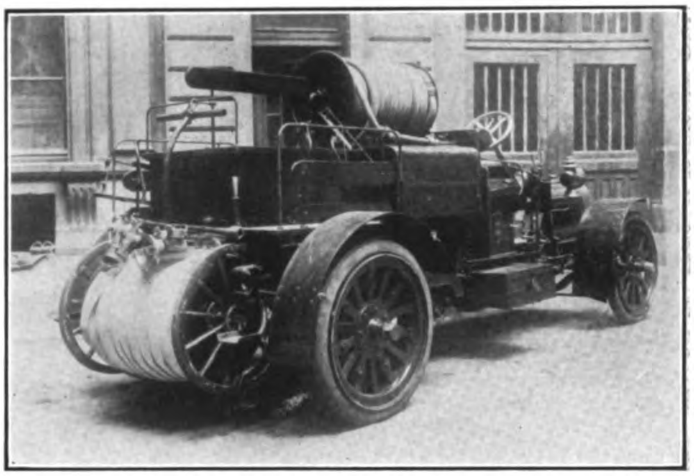
It will be understood that the part played by the first aid apparatus is similar to that of the chemical engine, in that as soon as the vehicle reaches the fire the pump begins playing upon the blaze, utilizing the water in the reservoir until such time as the suction tube can be connected. It is estimated that this will be sufficient in at least one-third of the fires, while in a majority of others the first aid will be able to hold the blaze in check until the arrival of the larger pumping engines. At the rear is carried a movable reel of regulation hose which may be used in case of an emergency.

ELECTRIC REFUSE CART.

German Municipal Authorities Experimenting with New Three-Wheeled Vehicle.

Gebhardt & Harhorn, Ltd., of Berlin-Schoneberg, Germany, has supplied an interesting three-wheeled refuse cart to the municipal authorities of one of the suburbs of Berlin. A feature of the vehicle lies in the fact that the body is removable, so that the chassis is available for other uses if desired. The machine is electrically driven.

The motive power is provided by means of an electric motor supplied with current from 20 150 ampere-hour cells. This is built integral with the front wheel



Delahaye-Farcot First Aid Pumping Engine Used by Fire Department in Paris, France.

and is of the direct current type. The armature rotates outside of the fields, and transmits power to the road wheel through a 5:1 reduction gearing. The car can be run forward or backward with equal facility, the reversal of the battery current being effected by means of a patented switch especially designed for use on this type of vehicle. The maximum speed is between 25 and 30 kilometers an hour, which is equivalent to 15-18 miles, and it is stated that a distance of 150 kilometers (93 miles) can be covered on a single charge.

The body which is at the rear is tipped and unloaded by drawing up a lever arranged at the right of the driver's seat. An automatic device for sanding the streets also is provided, the distribution of the sand being accomplished by an electric motor. This car is used for the collection of refuse accumulating in the streets after regular cleaning hours.

IMPROVED LOADING DEVICES.

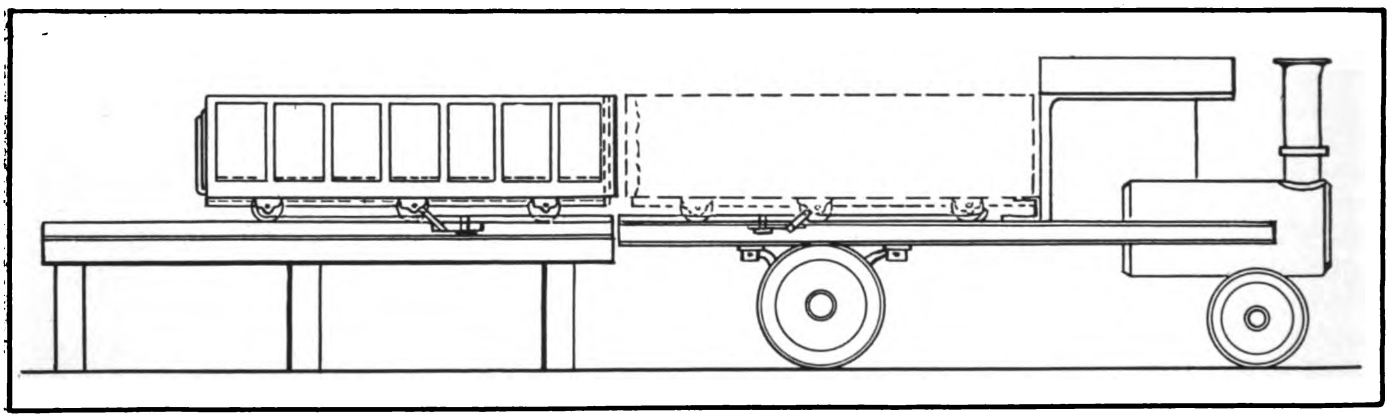
British Motor Vehicle Users Beginning to Study Problem in Scientific Manner.

Although it is generally regarded that motor transportation received careful consideration abroad before the industry realized its possibilities in this country, it is somewhat significant that the manufacturers have not assisted users to the same degree that has been true in America. It is only recently that many users of commercial motor vehicles in Great Britain, for instance, have begun studying some of the problems which have interested both manufacturers and owners alike in this country. While it is true that a few producers have made effort to provide suitable loading and unloading equipment, it would appear that in many instances the owner has been left to work out his own solution.

F. M. Smith, managing director of the Associated Coal Consumers, Ltd., of London, has only recently installed a system of interchangeable bodies for the handling of coal at the company's wharves, which has excited some little comment among motor vehicle users in England. In the first place, it must be known that for the supply of coal to private consumers in London it is necessary to pack it in bags, each of which is required to carry two hundredweight. It is this fact which makes it impossible to dump coal in bulk from the wharf to the wagon bodies. With public institutions, factories, etc., coal can be supplied in bulk without the necessity for separate sacking.

Mr. Smith found by experimentation that the average time needed for loading a wagon and trailer exceeded two hours. Under this arrangement the company's five-ton steam wagon was able to handle but three 10-ton loads a day. Obviously, there was decided need for some system which should reduce the waiting time, if the mechanical transport were to become a paying investment.

The interchangeable bodies are fitted with flanged wheels, and the wagon is provided with rails to take these, a simple locking device preventing the body from moving on the rails once it has been fixed in place. The principle involved is similar to that which has been utilized in this country and its main features are presented in an accompanying illustration.



Illustrating General Principle of Quick Loading Device for Use with Steam Tractor by Coal Concern in London, England.

In a recent demonstration, an empty body was taken from the wagon and replaced with a five-ton load in 4.5 minutes. Extra trailers are utilized, making it unnecessary to transfer the bodies on these. In the demonstration to which reference is made, the entire time consumed from the instant the wagon arrived at the wharf until its load had been replaced and the loaded trailer had been picked up was six minutes. This arrangement already has saved about 4.5 hours a day on the loading time, making possible two additional deliveries.

ARMY SUBSIDIES IN AUSTRIA.

Some Conditions That Will Have to Be Met by American Exporters.

The Austrian government, like the governments of Germany, England, France and Russia, provides motor trucks for army use by a system of subsidies to the private purchasers of a specified type, on condition that in case of necessity they shall be subject to the call of the military authorities. The subsidized vehicles are subject to call annually at the time of the manoeuvres and for the duration of hostilities in case of mobilization of the army, during which service owners receive extra compensation.

It is evident that the character of the roads of Austria and nearby countries determined the specifications of the truck open to subsidy. They are notable for their light carrying capacity, and the grade requirement, 16 per cent., is higher than for any country in Europe except England. The smaller size of vehicle necessarily means that a greater number would be required for the same work, but the mountainous configuration of Austria and the bad roads of adjacent countries to the south would render light weight and grade climbing power of prime necessity.

The government subsidies and specifications also determine largely the type of motor truck for general commercial use and thereby limit the field for imports. Buyers naturally prefer machines which earn subsidies to imported vehicles, even if the latter are cheaper and perhaps better. It would seem, therefore, that Austria would be a favorable market only for American light

delivery wagons for local use, in connection with which there would be no question of government service or subsidy, unless American makers could conform to subsidy conditions and induce the government to admit their vehicles to the war office lists. The specifications of wagons for such service in Austria are as follows:

Speed, 16 kilometers (9.9 miles) maximum, average 10 kilometers (6.2 miles) an hour, capacity for a grade of 16 per cent., 35 horsepower on 800 revolutions, rubber tires, fuel supply for 350 kilometers (217 miles), chain or cog drive, wheelbase of motor wagon 3,600 millimeters (11.8 feet), of trailer, 3,300 millimeters (10.8 feet), loading platform, 2,800 millimeters (9.1 feet) long, 1,800 millimeters (5.9 feet) wide; sides, 600 millimeters (1.9 feet) high with extra boards for sides 500 millimeters (1.6 feet) wide; fuel, benzine (gasoline) or benzol. The wagons should have a maximum carrying capacity of 3,000 kilos (6,614 pounds), the trailers of 2,000 kilos (4,409 pounds) capacity. Traction wagons to be qualified for subsidy must be made wholly or partly in Austria-Hungary. The purchasers of such wagons may, by placing them on the government registry, receive a subsidy at time of purchase of 4,000 crowns ($800) and 1,000 crowns ($200) a year for five years, which under certain conditions may be extended one year, in all 9,000 to 10,000 crowns ($1,800 to $2,000), and the motor truck remains for five to six years at the call of the government.

SELF-CONTAINED MOTOR PLOW.

Interesting New Agricultural Machine Placed in the Market by German Manufacturer.

In the Stock motor plow, produced by the Stock Motorflug, Berlin, Germany, is found an interesting self-contained agricultural machine. By self-contained is meant that the plowing attachment is connected permanently to the frame of the vehicle instead of being hauled by the latter as a separate implement. Perhaps the most striking feature is the large diameter of the two driving wheels, fitted with deep paddles for increasing their grip upon the soil. These are arranged in the centre of the whole vehicle, which is supported from the main axle and practically is balanced in a horizontal position.

The motor is a four-cylinder unit of 42-50 horsepower, which is carried with the radiator at the front of the main frame. Ignition is by Bosch magneto, and the carburetor is designed to operate on gasoline, benzol or other similar fuels. Power is transmitted through a clutch and change speed gearing, and finally by spur gears meshing with large diameter gears on the main axle. The whole of the transmission is enclosed in dust tight casings. Three speeds are provided for working under normal plowing conditions, while a fourth is added for particularly heavy soil.

Steering is by means of a hand wheel and irreversible gearing, which controls the movements of the single wheel pivoted at the rear and on the left side of the plowboard. This rear wheel is provided with a central flange to prevent side slipping and the steering movements are communicated to it through a long diagonal rod fitted with the usual type of ball joints. The end of the plow frame can be raised or lowered by means of a rack and pinion gear operated by a long endless chain taken from a sprocket on the end of a horizontal shaft fitted with a handle in front of the driver. Thus it will be seen that one man may drive the machine as well as attend to the six plows.

GENERAL NEWS FROM ABROAD.

Hospital Disinfecting Machines—The Magdeburg corporation in Saxony, Germany, has decided to purchase two automobiles each for the municipal hospital stations in the old city and the suburb of Sudenburg, which will be used for the purpose of transporting disinfecting materials.

Public Service Cars in New Zealand—Four companies, with an aggregate capital of some $150,000, have been organized in New Zealand for the purpose of exploiting the possibilities of commercial motor vehicles for public service corporations and others. A service already has been proposed for Timaru.

Japanese War Officials Experimenting—Announcement is made that for some time past officials of the Japanese war department have been experimenting with motor vehicles for army purposes in the vicinity of Tokio. A special committee has been appointed by the government for consideration of the problem.

Fire Apparatus in India—According to the Civil and Military Gazette of Lahore, India, the use of motor fire engines has been making considerable headway during the past five years, vehicles of this kind now being found in Calcutta, Bombay, Madras, Delhi, Lucknow, Allahabad, Hyderabad, Rangoon and various other large towns and cities.

Trucks for Italian Army—The Italian military authorities have been granted an appropriation of practically $2,000,000 for the immediate purchase of 700 motor vehicles. The order has been divided between the following makes: Fiat, 300; Zust, 200; S. P. A., 100, and Isotta Fraschini, 50 to 100. The last named are to be largely of the delivery van type, capable of carrying loads of about 1.5 tons. All the larger vehicles are to be fitted with steel tires. A test near Rome, culminating in a 2000-mile run, is to be given the different types in order to determine the modifications needed before the bulk of the order is filled.

New Commercial Car Accessories

Pyrene Fire Extinguisher.

The Pyrene fire extinguisher is produced by the Pyrene Manufacturing Company, 1385 Broadway, New York City, and is adapted for garage service and to be carried on the machine. It is very compact and weighs approximately five pounds. It extinguishes fires by the formation of an elastic non-poisonous blanket, which separates the flame from the burning material. It contains neither acid, alkali, salts nor moisture and will not injure any material with which it is brought into contact. The liquid is not employed under pressure, will not freeze and may be utilized on all classes of electrical fires without danger to the user. Pyrene is a double acting hand pump, easily operated, and the discharge is under the control of the operator at all times.

Amico Spark Plug.

A new spark plug presenting practical features has been brought out by the American Ignition Company, Inc., 319 Adams street, Dorchester, Mass. The construction of the Amico plug differs from that of conventional design in several particulars and the most striking point is the provision made for expansion of the porcelain, which material is utilized for insulating purposes. The porcelain is approximately an inch in diameter, making for extreme strength and durability and it should withstand severe usage. The metal shell of the plug is sturdily constructed and is provided with the usual hexagon, but the interior has a decided taper. This is for the purpose of compensating for the expansion of the porcelain and if such action occurs it is on an incline. The packing employed is asbestos, which is compactly wound around the porcelain, and the gasket is .75 inch high, making a perfect joint as well as one that is gas tight. The porcelain is retained at uniform pressure, by a vamped ridge. One of the qualities of the plug is the electrode on the shell, it being liberal in size and not easily sprung out of position through careless handling. The main electrode extends through the centre of the porcelain and the tapered end of the latter provides ample room for the gases to clean the points.

Dayton Airless Tire.

The Dayton airless tire is produced by the Dayton Rubber Manufacturing Company, Dayton, O., and is held to combine the resiliency of the pneumatic and the durability of the solid shoe. One of its several advantages is that it is puncture and blowout proof, as it does not depend on air for its resiliency or for maintaining its shape. It is constructed on the same principle as an automobile wheel in that there are piers or spokes of rubber and an annular rib of straight cut fabric and rubber. The spaces between the solid sections allow displacement of the rubber when the tire encounters an obstacle and eliminate jouncing or vibration. The piers of rubber are so constructed as to unite with and become a part of the casing and cannot be dislocated therefrom. The Dayton airless tire mileage guarantee is liberal.

Planhard Carburetor.

Springs, cams, levers, etc., are noticeable by their absence in the Planhard carburetor, made by the Planhard Manufacturing Company, 1790 Broadway, New York City, with factory at Kokomo, Ind. It is of the concentric type, the float chamber surrounding the mixing chamber. Proper vaporization of the fuel and the operation of mixing it with the air is accomplished by a double concentric air and mixture construction. The fuel nozzle is in the centre and is entirely surrounded by the fixed or constant air tube. The auxiliary air is admitted through a series of ball valves, which are seated in holes in an adjustable screw plate at the bottom of the auxiliary air tube. These seats vary in size, but the balls are of the same diameter and are lifted from the seats progressively as more air is required, the ball on the largest seat being raised first. This is held to eliminate fluttering and to make for a smooth operating motor. The spraying nozzle is cup shaped and when the engine is inoperative, this fills automatically with fuel to within a short distance from the top. This priming device makes for easy starting. The float chamber is provided with the conventional flooding device. Greater efficiency from the motor and economy of fuel are among the qualities of the Planhard.

Burn-Boston Batteries.

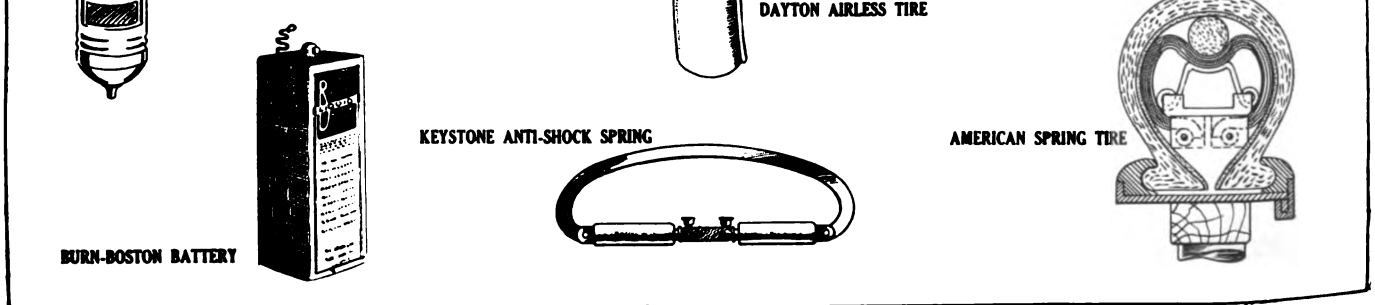
A battery having all the conveniences of the dry cell in that its size and shape are similar is the Burn-Boston, made by the Burn-Boston Battery & Manufacturing Works, 19 Doane street, Boston. It differs from the usual cell in that the electrolyte is a liquid and that it will not dry up. It is not affected by moisture or dryness nor will it deteriorate when out of service for a considerable period. The cells are securely sealed, preventing loss of the electrolyte, and are not impaired by vibration, etc. The connections are very durable and practical, the zinc member comprising a special wire equipped with a terminal, while the negative member is sturdy. The most prominent quality of the battery is its long life. Instances are quoted in support of this contention by the company. A special offer is being made and a booklet will be forwarded on request. The voltage of the battery is standard.

American Spring Tire.

The American spring tire is manufactured by the American Spring Tire Company, Chicago, and is held to combine the advantages of a solid and pneumatic shoe. It comprises an outer casing enclosing the resiliency members, which consist of a circular strip of solid rubber, resting on a number of springs, fitted with a form of roller bearing, and a housing is provided for both members. The springs are also reinforced by a bridge. Brass friction leaves are utilized between the primary springs and the outer casing is fitted to a clincher rim.

Keystone Anti-Shock Spring.

The Keystone Spring Works, Philadelphia, is marketing the Keystone anti-shock automobile spring, which is applied to a vehicle in the same manner as a conventional full elliptic spring, being clipped to the axle and body. The top frame is of a special steel with the two cylinders of Shelby seamless tubing. Springs are utilized inside the cylinders and these include an oil shock absorber, actuated by a ball valve in the end of the piston connection. The lubricant is retained by a special stuffing box and provision is made for replenishing the supply. It is claimed that road shocks are completely absorbed and that the car will ride as easily empty as loaded.



Some New Accessories, Including Pyrene Fire Extinguisher, Amico Spark Plug, Dayton Airless Tire, Planhard Carburetor, Etc.

THE A B C OF MOTOR TRUCK IGNITION.

Part IX--The Bosch Timer-Distributor and Its Functions--Make and Break Systems and the Principles of Operation---Types of Igniters and Their Characteristics---Magnetic Plugs and the Arrangement of Components.

By C. P. Shattuck.

SUPPLEMENTING the previous discussions of devices for distributing and synchronizing the high-tension current, the Bosch timer-distributor illustrated at Fig. 46 is of interest in that it presents many practical advantages. Although designed for installation with motors having two sets of spark plugs, and to be utilized in connection with a magneto, it can be employed when the only source of current is a battery. With both the magneto and battery the system provides two independent circuits controlled by one switch.

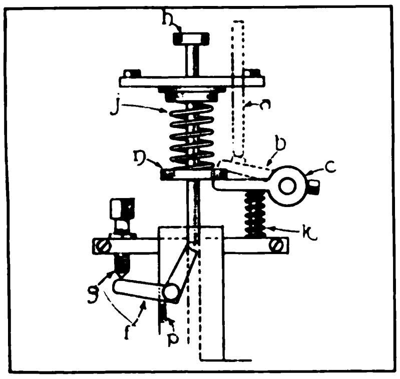


Fig. 44—Make and Break System Utilized with Two-Cycle Single-Cylinder Motors.

The battery and distributor system comprises a combined coil and switch and the timer-distributor, the latter being shown at Fig. 46 A and B. It is attached to a shaft operating at camshaft speed by means of a sleeve a and locked by a taper bolt. The base plate c is provided with two ball bearings upon which the sleeve rotates, and attached to the sleeve shaft is a steel cam k, having as many projections as there are cylinders. The circuit breaker lever w is held against the cam by a spring m and normally the platinum points n and o are in contact. The short platinum point n is secured to the lever, while the screw member o is screwed into the insulated block p, and is adjustable and locked by a nut.

It will be noted that the block p and platinum point o are insulated from the base of the timer, and are connected to the primary winding binding post r. The circuit breaking lever, however, is grounded. The positive terminal of the battery is connected to this post and when the contact points are together the current flows from the positive terminal of the battery to the brass block p, lever w, ground, switch terminal, metal plate in coil, through the primary winding of the coil, switch plate, and to the negative terminal of the battery.

Operation of Timer.

When the cam rotates, a projection separates or breaks the contact of the platinum points, interrupting the flow of the primary current, and the reaction results in the production of a high-tension current in the secondary windings. The operation of the timer is similar to that of the commutator previously described, differing only in that the break of the circuit is accomplished by separating points and not by the wipe method.

The distributor is mounted above the timer. The distributor rotor b carries a brass tube, and a carbon brush s is also included, this projecting laterally. In its rotation the brush sweeps a cylindrical cavity formed in the distributor plate or disc e. A contact is provided for each cylinder, one of the members being shown at f. Another carbon brush h is fitted, this being employed to convey the high-tension current from the coil to distributing mechanism. One of the terminals to which is connected the cable leading to the spark plug is shown at r. Synchronization is secured through the mechanical breaker or interrupter, the principle of which is the same as that utilized with magnetos.

Make and Break Ignition.

One of the simplest forms of ignition is the low-tension, sometimes designated as "make and break." A low voltage source of electrical energy is utilized; in the average case about five or six volts, but the resistance of the circuit is such that from one to two amperes, or in some cases as high as five, flow when the circuit is closed.

At Fig. 45 are shown the essential components of a low-tension system of the simplest type. They comprise a battery, switch, insulated stationary electrode, movable electrode, wires and coil. The last named dif-

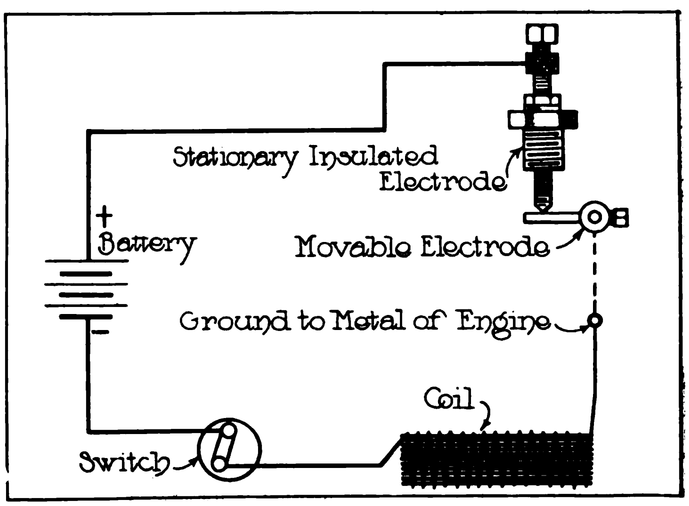


Fig. 45—Illustrating Components and Circuit of Low-Tension Make and Break System of Ignition.

fers from the induction coils previously outlined in that it comprises a number of turns of coarse wire wound around a soft iron core. It is termed a "kick,"

"reactance," "intensifying," etc., coil, and it is of the induction type, but the increase of voltage of the battery current passing through it is only momentary.

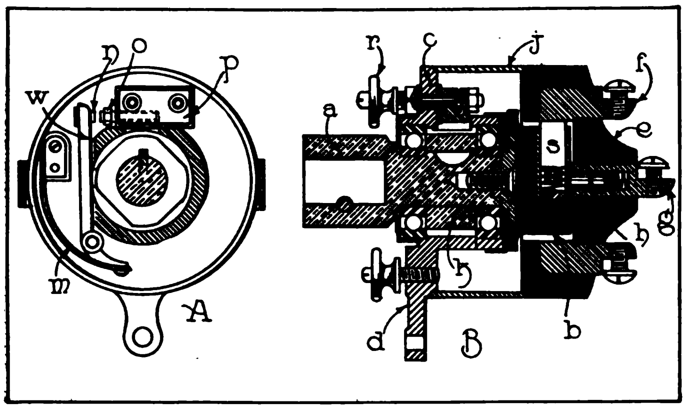


Fig. 46—Bosch Distributor and Interrupter: A, Showing Contact Points and Method of Breaking Primary Circuit; B, Sectional View of the Timer-Distributor.

With the components arranged as illustrated in the drawing, the circuit is closed, the current flowing from the positive terminal of the battery, for example, to the stationary electrode. The latter is screwed into the cylinder of the motor and carries a metal pin, which is insulated from the metal of the engine by suitable material—usually mica. The movable electrode being in contact with the metal of the motor—in practise it is located in the combustion chamber of the cylinder, also touching the pin of the stationary electrode—current will flow as the circuit is completed or closed. Upon the electrodes being separated by mechanical means the breaking of the contact causes a spark to pass between them, igniting the mixture.

The system is very simple, eliminating as it does the vibrator and timer, but it is not free from trouble in that the mechanical parts are subject to wear. There is also more opportunity for loss of compression around the movable electrode. It is utilized largely on marine or stationary two-cycle engines and the arrangement of the mechanism controlling the timing of the spark with the marine type is shown at Fig. 44.

The stationary and movable electrodes are designated by a and b respectively, and these members are shown in contact. On the outside of the cylinder is a sliding rod p, actuated by an eccentric rod attached to the motor shaft. On the plunger h is mounted a thimble n, which is held in contact with the movable electrode by a spring, the tendency of the spring always being to maintain the electrode in a horizontal position. A spring k, however, is placed under the electrode, but its tension is considerably less than that of the other member, being utilized to force the movable electrode up into contact with the firing pin.

On the slide rod is an angular dog f, pivotally mounted, and this member is tripped by an adjustable screw mounted on an extension of the cylinder. Normally the tension of the spring j on the thimble n prevents the movable electrode from making contact with the firing pin, but upon the slide bar rising, the dog f compresses the spring j until the electrodes are in contact as shown by the dotted lines. A further movement of the slide bar causes the dog to be tripped by the screw g, resulting in breaking the contact between the electrodes through the energy of the spring applied to the thimble and movable electrode. The separation of the electrodes occurs at the completion of the compression stroke, and with some types of make and break mechanism the screw member g may be raised or lowered by hand to bring about an earlier or later break.

Other Forms of Igniters.

The system described is suited to the two-cycle motor, but is not adaptable to the four-cycle engine because of the increased number of strokes. While it would be possible to employ it by utilizing reduction gears, etc., to obtain the break at the proper instant, the mechanism would be too complicated to be practical.

The make and break system of ignition formerly was favored by several makers of motor cars, but it has been supplanted by the jump spark and magneto. As there are a number of converted machines the operation of the older system will be of value to the novice not familiar with the application of the principle.

At Fig. 47 B are shown the components of an igniter. The low-tension current is led to the insulated busbar a, which has a knife switch b, the latter providing means for cutting out the cylinder if desired. The igniter plate c is made cone shaped to fit the cylinder and is secured by three bolts to a corner of the combustion chamber over the inlet valve. It carries an insulated anvil, or fixed electrode f, and a hammer or movable electrode d. The latter is L shaped and includes an arm or lever e, which is actuated by a lifter rod n carrying a spring h. The rod is given a vertical movement by the rotating cam on the camshaft. During the upward movement the hammer and anvil are in contact, but upon the cam completing its movement

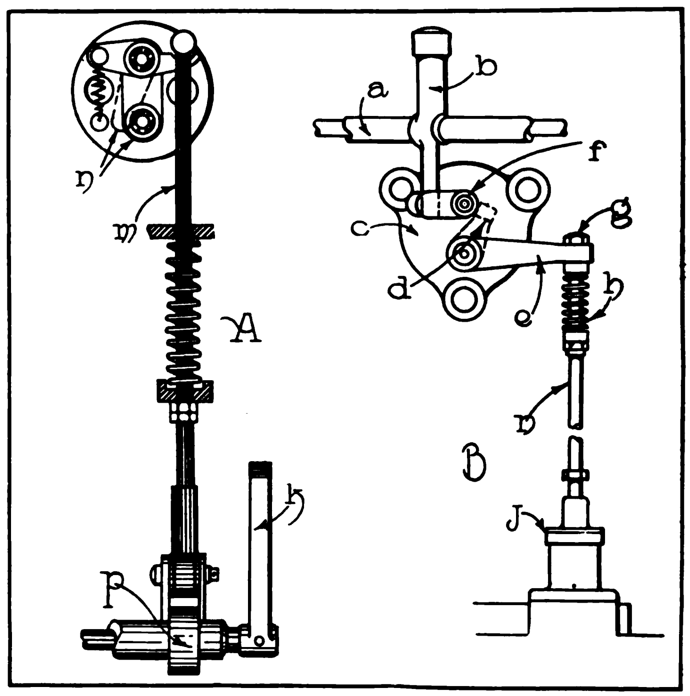


Fig. 47—Forms of Igniter or Make and Break Systems: A, Bosch Low-Tension; B, Igniter Mechanism Formerly Employed on Well Known Makes of Pleasure Car.

the lifter rod falls, this action being accelerated by the spring. Consequently the contact is broken and a spark is created much in the same manner as it is ef-

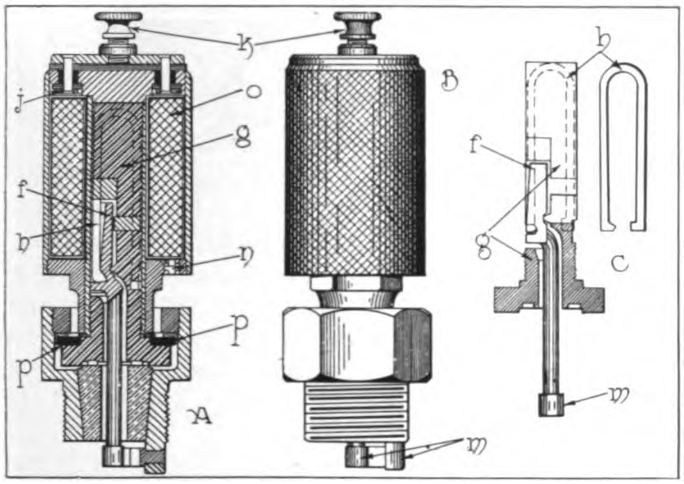


Fig. 48—Bosch Magnetic Plug System: A, Sectional View of Plug; B, Showing Contact Members Actuated by Electricity Generated by Oscillating Armature of Magneto; C, Components of the Make and Break Device.

fected in the marine type of make and break.

The method of obtaining the break in the Bosch low-tension system is of interest as a low-tension magneto is utilized and differs from those employed with high-tension systems of ignition. The breaker or interrupter mechanism is shown at Fig. 47 A and is adaptable to automobile and stationary motors with mechanically operated tappets. Two types of magnetos are constructed and the electricity is produced by a stationary armature, the current being interrupted in the explosion chamber of the cylinder by mechanical means. The magnetos are suitable for one and multi-cylinder engines with more than 350 revolutions a minute and maximum efficiency is claimed for the system.

Principle of Make and Break System.

The principle of the make and break mechanism is similar to the systems described and the construction is such that the cone shaped member inserted in the cylinder is gas tight. It carries an insulated pin contact with which is made by an interrupter arm, these members being indicated by n in the drawing. Normally the parts are together, but upon their separation a spark occurs.

The movable electrode or interrupter is actuated by an outside tappet m, the latter being operated by a cam p. The timing of the spark is effected from the camshaft of the motor and a timing lever k permits of late or early ignition.

Low-Tension Magneto.

The magneto utilized with the system is shown at Fig. 48 and its construction and operation will be described briefly as the subject of magnetos will be taken up in detail in logical sequence. As previously stated, the armature is stationary and because of this the electricity can be utilized directly, the ends of the armature winding being connected with terminal screws and without the aid of carbon brushes, etc.

By referring to the drawing it will be seen that the armature is located between the pole shoes of the double magnets, and that between the armature and pole shoes is an iron sleeve, the rotating member. The beginning of the winding is connected to the armature core. The end leads through the spindle insulation of the rear armature spindle to a terminal, being connected to this by means of a cable connecting screw. The sleeve is carried by the two end plates and lubrication is effected by felt wicks.

During each revolution of the sleeve, four sparks are produced, it revolving at half the speed of those having a rotating armature. A maximum current is secured four times each revolution, one after each 90 degrees. The period during which the contacts may be broken to obtain the spark varies through an angle of 30 degrees measured on the magneto shaft. The correct time for breaking the contact is when the sleeve is a few degrees past its horizontal position. The speed of the sleeve varies according to the different motors. On one, two and four-cylinder units it is driven at camshaft speed; with three-cylinder engines at three-quarter speed, and on six-cylinder motors, 1.5 times.

The current generated is carried from the terminal by an insulated wire to the pin of the sparking flange, through the interrupter arm and motor frame, back to the body of the magneto, the circuit being completed only when the points are in contact.

Magnetic Plug Ignition.

A system making for simplicity in that the make and break of the circuit is accomplished electrically is the Bosch magnetic plug ignition or Honold system, illustrated at Fig. 49. It is designed for single-cylinder engines utilizing gas, gasoline, kerosene or spirits, and not exceeding 250 revolutions a minute. The usual mechanical contact breakers, etc., are eliminated, the interruption of the circuit being effected by the current itself. The latter is generated by an oscillating motion of the armature of the magneto between the pole

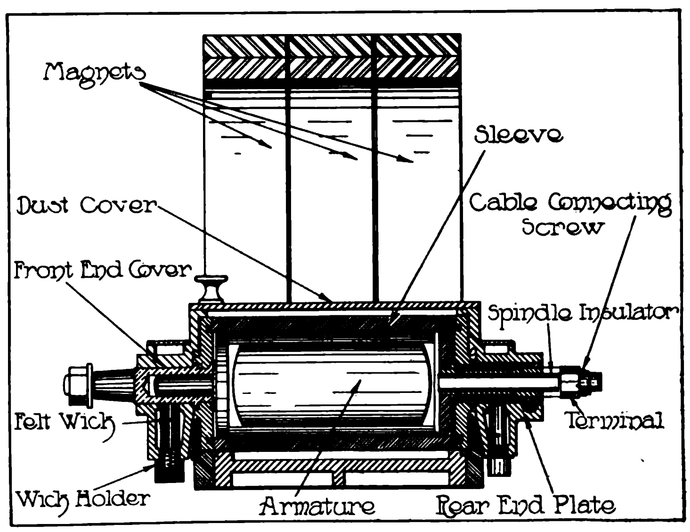


Fig. 49—Sectional View of Bosch Low-Tension Magneto Utilized with Make and Break Device Shown at Fig. 47 A.

shoes of permanent steel magnets. The movement is produced by two springs operated by a bell crank lever from the camshaft of the motor.

The assembled magnetic plug is shown at B and is screwed into the cylinder in the conventional manner. It comprises a plug body having a hexagon nut and thread, a coil body and the arrangement shown at C. The contacting pieces, electrically operated, are illustrated as m at B.

Components of System.

The arrangement of the sparking components is shown at C, these comprising an interrupter lever f, a pole piece g and a U shaped spring h. The electrodes m are forced into contact by the spring h as one end of the latter presses against the back of the interrupter just inside of a steel knife edge. The spring has a very slight movement and is well protected from the heat of the combustion of the gases. The contact pieces m are mounted on the interrupter lever f and the plug body, and are separated only at the time of sparking, at which moment a current flows through the coil o.

To accomplish this action, one end of the winding is in connection with the current carrying ring j, while the other is electrically connected by means of the screw n to the body of the coil. The coil, pole piece and the interrupter are insulated from the plug body by a steatite cone and mica washers p.

The operation of the system is simple. Reference has been made to oscillating armature of the magneto. This is moved out of its resting place through an angle of 30 degrees at the moment of ignition, and is pulled back to its original position by balance springs. This movement is brought about through the operation of the camshaft of the motor by means of a rotating thumb piece or other suitable device. For this purpose a double bell crank lever is attached to the cone of the armature spindle, to the horizontal arm of which are fixed the balance springs, whereas the vertical portion of the bell crank lever is actuated by the attachment on the camshaft.

By the movement of the bell crank lever a tension is brought on to the springs, which are released again at the moment the camshaft thumb releases the bell crank lever. The springs thus force the magneto into its original position again and by this movement a current is produced in the winding of the armature. The current passes from a terminal on the magneto through an insulated cable to the terminal k on the plug, through the coil of the latter and returns through the interrupter, motor and magneto body to the armature winding. The magneto has no retard or advance, but this may be accomplished mechanically on the motor itself.

(To Be Continued.)

Ed. Note—The next installment will deal with mechanical generators of electricity, defining the principles involved and their application in practise.

The H. T. Jenson Company, Sheridan, Wyo., has sold two Nyberg 1.5-ton trucks to the largest wholesale grocery concern in that city.

FEDERAL DEMONSTRATES VALUE.

Helping Horse Wagon up Long Grade Results in Sale of Four Machines.

While demonstrating a Federal truck to a prospective customer over Fillmore street hill, San Francisco, Cal., P. S. Nichols, general manager of the Standard Motor Car Company of that city, Federal agent on the Pacific Coast, overtook a two-horse truck that was striving vigorously to make the grade, but was unable to do so with its heavy load of furniture. A rope was secured and the Federal acted as aid and easily towed the team and load the remaining two blocks to the summit of the hill. The teamster was so impressed by this performance that he related his experience to his employer.

Several days later, Mr. Emmons, president of the Emmons Draying Company, called on Mr. Nichols and investigated the Federal trucks. After going over the subject of its pulling qualities and its cost as compared with horse delivery expense, Mr. Emmons placed an order for a truck. Since trying out his first purchase, Mr. Emmons has repeated his order and now has four Federals in his service. He is now one of the most enthusiastic truck advocates on the Pacific Coast.

KELLY TRUCK PROVES EFFICIENT.

One of the First Water-Cooled Models Shows Little Wear After Covering 21,000 Miles.

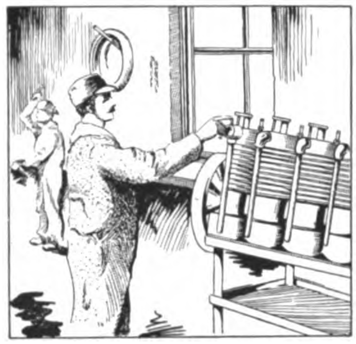
A three-ton Kelly truck, made by the Kelly-Springfield Motor Truck Company, Springfield, O., in the service of the Wagner Transfer & Storage Company of that city, has covered more than 21,000 miles and is now running as well as ever. Jacob Wagner, president of the company, is authority for the statement that today his Kelly truck is the easiest running vehicle he has owned in several years.

The chassis contains one of the first water-cooled engines built by the Kelly-Springfield company. Before it was sold to Mr. Wagner this vehicle was put through 18,000 miles of strenuous factory and road tests. It was then taken down and failed to show wear in any place. The machine was then reassembled and sold to Mr. Wagner. Since then it has covered more than 3000 miles in the service of his company.

The Rochester Hille Mining Company, Rochester, Nev., has purchased a Knox-Martin tractor, which is being used to haul ore from the Codd lease on Nenzel mountain over the Nixon ore road to the railroad siding 12 miles distant. New ore carrying wagons have been built at San Francisco and it is planned to draw several in one train with the tractor as motive power.

HINTS·FOR·PROPER MAINTENANCE

A Department for the Owner, Driver and Repairman.



THE high cost of fuel is an important factor in the operation of commercial vehicles and makers of carburetors are devoting their efforts to produce a device which will permit of the use of heavy fuels. The difficulty experienced with kerosene is in starting a cold motor, but the Air-Friction Carburetor Company, Dayton, O., maker of vaporizers bearing that name, announces a new model known as B. It is constructed to utilize fuels heavier than gasoline and the company states that of the number in actual service, in some instances two parts kerosene are employed to each part of gasoline, while others use the fuels in equal proportions.

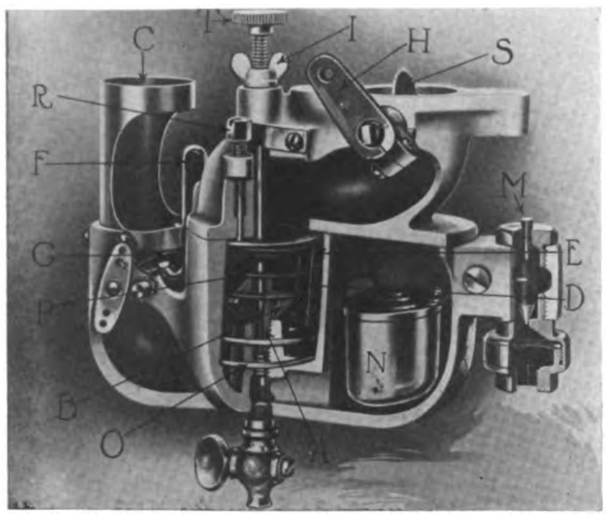
A sectional view of the new carburetor is presented in an accompanying illustration with each component lettered to make clear its application. The use of kerosene is held to be possible by the large wetted surface presented by the spray nozzle A, which retains the mixture in a film between two discs B, .01 inch apart. The air is taken through one source C, being previously warmed by passing around the exhaust pipe, and being conveyed to the vaporizer by the usual flexible metal tubing. As the heated atmosphere enters it lifts a truncated valve D, which is enclosed in a valve cage E, thus providing the motor a proportionate volume of mixture at all speeds.

As the heated air passes the spray nozzle A it becomes saturated with the fuel, forming a gas instead of a spray, and is drawn into the cylinders without vacuum being created. The maker maintains that it is superior to a spray full of globules, as the latter are difficult to lift and allow a large percentage of the mixture to condense.

To overcome the difficulties of starting with a heavy fuel a U shaped plunger F is operated by closing the air butterfly valve G, pushing down the valve cage E and its truncated valve D, to restrict the air. This enriches the mixture required for starting. Upon gradually releasing the air butterfly valve G the cage E resumes its natural position. The velocity of the incoming air is dependent upon the valve opening of the throttle. The fuel adjustment is secured by loosening the small winged, thumb jam nut I and rotating the needle T. The adjustment of the air is by the small hexagon nut R. The bowl and top are constructed of aluminum and the float needle M of brass with an imported alloy. The float N is of drawn metal. The only spring utilized is that at O, it being employed for pushing the valve into place when the air butterfly member is released, and the small one P is entirely enclosed to prevent tension loss. All levers, nozzle parts, etc., are of brass.

CLEANING THE RADIATOR.

Those who removed the anti-freezing solution from the radiator and did not clean the cooler will do well to give this member that attention it deserves. The opening of the petcocks and draining off the old fluid and refilling with fresh water will not serve as there

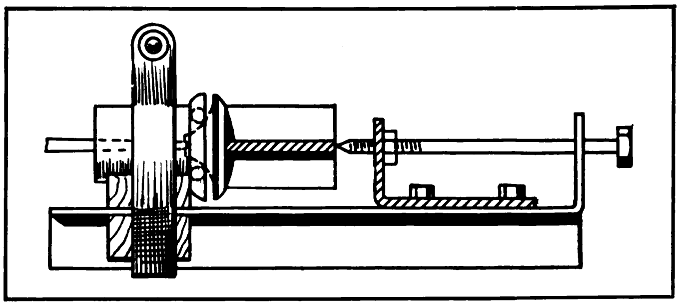


New Air-Friction Carburetor, Designed to Employ Heavy Fuels Mixed with Gasoline.

is more or less boiler scale which forms and which is deposited as a fine, brick colored powder. This accounts for that reddish colored water when the cooler is emptied.

The circulation system should be cleaned because of the scale created by hard water. While some make a practise of changing this frequently the best method is to take as many common washing soda crystals as will dissolve in water, the fluid equalling the amount used in the system. After emptying out the old water, pour in the prepared solution and run the motor for a considerable period. Some take the machine out for a couple of hours.

Next drain off the soda solution and refill with fresh water and again operate the motor. If upon removing the fluid it shows discoloration, refill with clean water and again run the motor. Another method is to open the petcocks and with the engine running feed fresh water into the radiator, just enough to replace that which is running out.



A Valve Trueing Tool That May Be Constructed Easily and at Slight Expense.

The exterior of the cooler should receive attention as the accumulation of dirt between the fins lowers its efficiency. By using a hose and playing a mild stream from the back of the cooler the dirt may be loosened easily. The magneto should be covered during the operation and the water should never be directed at the front and through the cooler to the motor.

HOME MADE VALVE REPAIRING TOOL.

The condition of the valves and seats is an important factor in proper maintenance of the motor and as these parts are subject to wear it may be necessary to true them. Usually the work is carried to the expert because of lack of proper facilities, but it may be accomplished by the owner or driver, provided he has suitable tools.

It is a simple matte: to make a valve trueing machine and in an accompanying illustration is presented a design which may be constructed easily. The bed is made out of a piece of three by three-inch angle iron about 20 inches long and .375 inch thick. At one end the webs are cut off and the end bent up at right angles for about three inches. The fast headstock is made from an old steering pillar ball race taken from a scrapped bicycle or purchased at some bicycle repair shop.

The headstock rests on a wooden block hollowed out to suit the height and diameter of the ball race. The entire headstock is clamped together by a piece of one-inch by .25-inch iron, bent and drilled to take a .375-inch bolt, as shown in the sketch. The tailstock is made up of a piece of .375 by nine-inch flat iron. This is drilled to suit the height of the headstock and is also bent over and tapped to take a .625-inch centre screw, which is fastened down by two three-inch screws.

The valve to be trued must have a slot cut in the stem, similar to that utilized for holding the screw driver when grinding, and should be placed up against the race as shown in the drawing and the back centre screwed up. The balls in the race are retained in position by the use of hard grease. A bitstock with a screw driver may be employed for rotating the valve, one person doing this work while another trues up the valve with a hand tool which may be made from an old file. A true surface may be cut by this method and the device will take valves of different diameters.

NEED OF PROPER LAMPS.

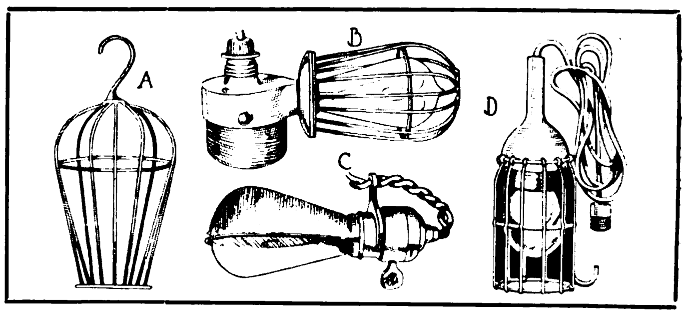
In changing over the stable to accommodate the commercial vehicle, or planning a garage, the lighting problem should be given proper consideration. It is an excellent plan to have extra sockets installed and in convenient places for more or less night work will be necessary where the driver cares for the machine. If the equipment is to include machinery the wiring plan of the lighting circuit should include drop lights with suitable shades.

In selecting the inspection lamps there is a wide variety from which to choose and in an accompanying illustration are shown several conventional designs. The hand or inspection lamp should be substantial, easily adjusted, and equipped with a hook for suspending the light when working about the chassis. The cord should be heavy and of a high grade material as it is subjected to hard service.

The reflector illustrated at C is very useful when working over the bench or lathe and it can be purchased for a few cents. The lamp shown at B presents practical features in that it is self-adhering, operating as it does on the magnetic principle. This enables the workman to utilize it where the ordinary member cannot be secured.

ACETYLENE TUBING.

With some types of generators more or less moisture forms in the tubing conveying the gas to the headlights and if the system is not provided with a trap for catching the fluid, considerable trouble will be experienced. Water in the piping is usually denoted by a flickering of the flame and a small blaze. Remove the tubing from time to time and blow out the water to prevent its creating trouble when the use of the lights is most desired.

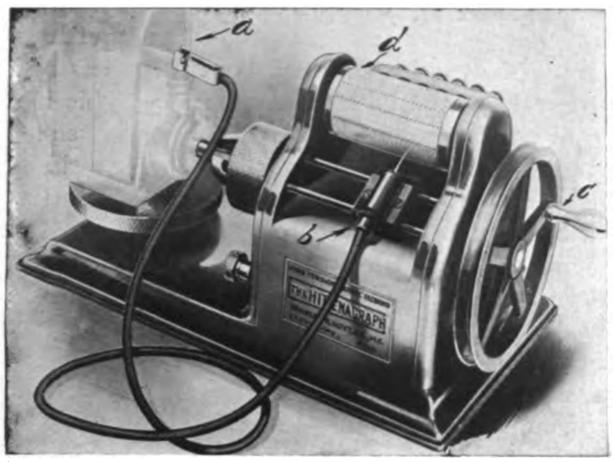


Suitable Inspection Lamps for the Garage: A, Type Utilized in Repair Shops; B, Magnalamp, an Electrical Device Self-Adhering to Metal by Means of Self-Contained Magnet; C, Magna Clip and Reflector Useful Over Work Bench; D, Inspection Member.

GARAGE AND SERVICE STATION EQUIPMENT.

IGNITION TESTING DEVICE.

An instrument designed for testing high-tension currents, magnetos, etc., has been brought out by Francis R. Hoyt, Cleveland, O. The name, Hitenagraph, is derived from its function, that of creating a graphic record of the secondary current.



The Hitenagraph, Designed for Testing High-Tension Currents, Magnetos, Etc.

The device is shown in an accompanying illustration testing a magneto for accuracy of performance. The Hitenagraph is simply constructed and its base is provided with a stand for mounting the magneto. The armature shaft of the latter is secured to the driving shaft of the testing device by a coupling similar in construction to the chuck of a drilling machine. The connection is so designed that the tapered shaft of the magneto may be held securely.

Rotating the driving wheel C revolves the armature of the magneto. The wheel is fitted with a handle, although its periphery has a V groove, permitting drive by a belt if desired. The drive is direct, there being no reduction. The chart drum revolves at an increased speed and the design is such that the spark index b which travels (through connection with a worm) longitudinally across the drum, is always diametrically adjacent, at the time the discharge should occur, to the ordinate on the chart itself on which the last produced spark registered. In this manner is shown, by the alignment of the sparks on the chart, the relative timing or synchronism of each cylinder, also the intensity of the spark by the area affected by it on the chemically prepared chart.

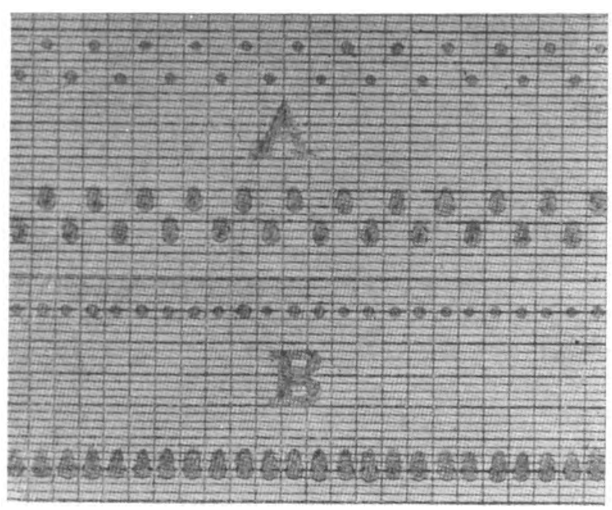
Two sections of the chart are reproduced herein, that marked A illustrating a typical case of lack of synchronism. The lines across the chart represent degrees of crankshaft rotation, or in other words, the chart as attached to the drum, is divided into 180 degrees and travels twice as fast as the magneto being tested. Each time the latter produces a spark, which is ordinarily twice a revolution, or 180 degrees apart, the chart makes a complete revolution and each succeeding spark should fall on the same line of the chart as the one preceding it. In the illustration at A the record shows that the magneto is five degrees out of time. The difference in the size of the spark at retard and advance, is also indicated. At B is presented a record of the same magneto after being repaired and adjusted.

The Hitenagraph may be utilized for testing a magneto without removing the latter from the car, a smaller model being manufactured especially for garage service. The larger or bench model is for use in factories and it is stated that it will test 20 machines an hour. This latter design is equipped with a variable speed device, and a tachometer giving graphically the revolutions a minute.

WOBBLING REAR WHEELS.

A large number of pleasure vehicles are converted into commercial cars and one of this type came into the garage with the rear wheel so loose on the axle that when it was jacked up it displayed an enormous amount of side play. The axle was fitted with a long, square key to drive the wheel. This was prevented from coming off by a .375-inch pin through the hub and shaft, which were both so badly worn that new members seemed almost necessary, but after some study the foreman devised the following plan:

The shaft was turned down .0625 inch for the length of the hub. The latter was removed from the wheel and bored out the same amount, leaving room for an .125-inch bushing which was constructed from steel tubing and brazed into the hub. The keyway was cut through the bushing to coincide with that in the hub, the one in the shaft deepened, and both widened to fit a new key. Then the wheel was assembled, placed on the axle, the pinhole drilled through the bushing, reamed, and a new pin driven in.



Chemically Prepared Chart Recording Lack of Synchronization at A and Proper Timing at B.

CORRESPONDENCE WITH THE READER.

Wattage of Lamps.

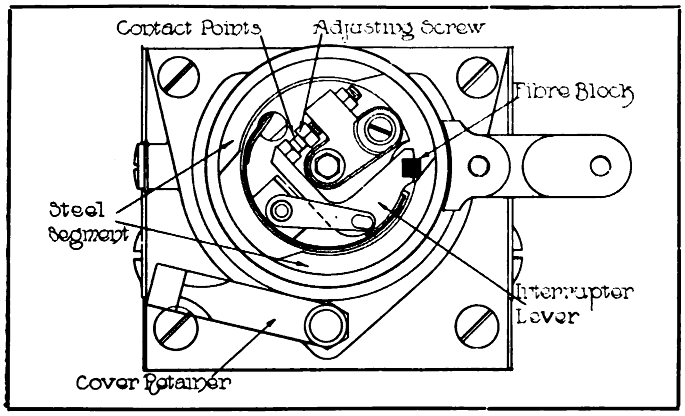
(30)—How do you ascertain the wattage of lamps; that is the number of watts consumed in an electric circuit, such as with lamps? CURIOUS.
Indianapolis, Ind., April 23.

To find the watts consumed in a given electrical circuit, such as with lamps, multiply the volts by the amperes.

Fitting Pistons to Cylinders.

(31)—I am contemplating fitting a new piston and rings to a motor that I am overhauling. Intend to make the piston and rings and would like to know how much clearance to allow between the piston and the walls of the cylinder. INFORMATION.
Albany, N. Y., April 26.

The usual clearance is about .001 inch, although there is a difference of opinion. Much depends upon the cooling efficiency, and as to whether the motor is air or water-cooled. Less than .001 inch has been used with success, but more is common practise. Before fitting a new piston it would be advisable to examine the cylinder to ascertain whether or not it is true. If not it should be rebored as fitting a new piston and rings to a worn cylinder—one that is out of true—will not warrant the expense and labor involved.



Illustrating Components of Breaker Box of Bosch Magneto.

Breaker Box of Magneto.

(32)—I have a small car I employ in my business, which has a high-tension magneto. It went out of commission the other day and I had to send for one of my trucks to be towed back to the garage. The workman said the breaker box was the cause of the trouble and that dirt had got into it. He advised covering the magneto, which I have had done. His explanation was rather meagre and I would be pleased to have the breaker box explained to me in simple language. MOTOR TRUCK READER.
Brooklyn, N. Y., April 12.

Dirt, grit or dust has no place in the breaker box of a magneto and the trouble was doubtless due to the grinding down of the fibre block which is employed in the circuit breaking mechanism.

In an accompanying illustration is presented a drawing of the breaker box of the Bosch magneto and the components are lettered to make clear their application. It will be seen that a fibre block is mounted on what is termed the interrupter lever, which also carries a spring for the purpose of keeping the platinum points normally in contact. The lever being pivotally mounted the points are separable when pressure is applied to the fibre block by the two segments.

The entire construction is attached to the armature shaft and revolves with it. The breaker box has two steel segments, which may be described as a ring with two pieces cut out and at exactly opposite points. When the lever is in such position that the fibre block is in the cut-out section the points are together, but when the shaft rotates further the fibre meets an obstruction and naturally is moved inward. This moves the interrupter lever, breaking contact between the platinum points and a contact is remade when the fibre reaches the cut-out section between the segments.

One platinum point is fixed, the other is adjustable and by loosening a lock nut the screw may be moved in or out as desired. The proper distance is about .5 mm and the points should be set with a Bosch wrench, which accompanies each magneto.

The housing containing the breaking mechanism is so mounted that it may be moved slightly, a lever arm being provided for this purpose. Advancing the spark, as it is termed, means that the housing is rotated a short distance so as to bring about an earlier breaking of the points. Retarding is the opposite movement.

The function of the breaking mechanism is to interrupt or break the primary circuit and this operation is practically the same as that of the timer or commutator employed with battery ignition and an induction coil. The primary circuit must be broken at just the proper instant; that is, when the piston is at the proper point and the cylinder filled with a compressed mixture.

The fitting of a cover to the magneto is to be recommended as the trouble shows that the instrument was exposed to road dust, etc.

Testing Out Leads.

(33)—What is the best method of testing out wires? In rewiring the motor of our truck I had considerable trouble as the wires are carried in a tube. I had to pull them all out and mark the ends before getting straightened out. DRIVER.
Fort Wayne, Ind., April 20.

There are several methods of locating a wire in a group as mentioned. One is to connect one end of an exposed lead to a battery and the second wire from the cells to an ammeter. The positive pole of the battery and that of the measuring instrument should be connected. By taking the free ends of the wires in the tube or elsewhere and touching one of them at a time to the free pole of the ammeter, the indicating hand will move when the proper wire is attached. This will close the circuit, denoting the cable.

A storage battery may also be used for testing. Attach one end of any of the group of wires to one pole of the battery and try each of the other ends on the remaining pole of the battery until a spark is noted. The same method may be employed with dry cells, but the spark will be much weaker and harder to distinguish. All that is necessary is to close a circuit.

ALL-METAL MOTOR TRUCK WHEELS.

The Development of Solid and Hollow Types and the Qualities Demonstrated from Continued Operation and Careful Experiment—Characteristics of the Best Known European and American Constructions Now in Use.

IN THE previous installment of this article the construction of wooden wheels for automobile vehicles was reviewed to considerable length, and it was shown that there are no standards of material or dimensions recognized, other than the standard established by the S. A. E. for rims. Not only this, that the wheels were often designed by axle makers, and are sometimes the result of figures compiled by a draftsman.

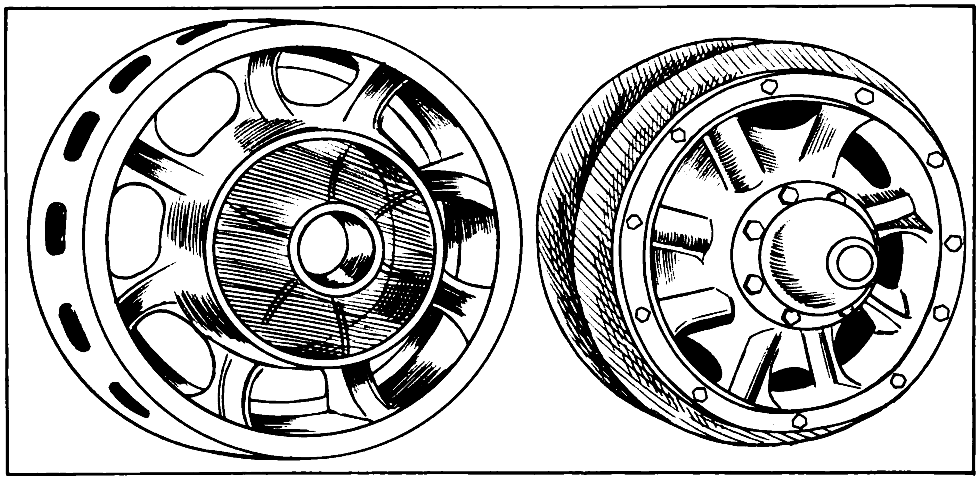
In this country, as has been emphasized, better qualities of wood are available than in Europe, though superior grades may be obtained on the Continent than in England. While it is true that the roads of Europe are much better when averaged than those of America, and this condition may offset the superiority of the American wooden wheel when endurance is analyzed, there is no doubt that the limitations of wood have been more carefully studied abroad.

It was the knowledge of the lack of strength of the wood wheel that prompted the construction of wire wheels, which were a development from the wire bicycle wheels, and though the first motor vehicles were often fitted with wire equipment, the wood wheel was later adopted very generally. In the creating of racing cars wire wheels came into favor, and the service resulting was such as to lead to the use of this construction by a number of leading makers. The car manufacturers of England have maintained that the uncertain strength of wood, the lighter weight and the longer endurance of wire wheels were all important factors in their very general choice of the latter. The use of wire wheels, however, was by no means confined to England, and a considerable number of builders of continental Europe have adopted them.

Wire wheels, however, have never been regarded with approval for service wagons, save for light vehicles, and with the utilization of heavy machines more attention was directed toward the development of metal constructions that would have greater strength and be lighter in weight. In fact weight has been a very potent factor in motor vehicle construction abroad because of the extremely high cost of fuel, and the desire to use the smallest engines that would afford sufficient power.

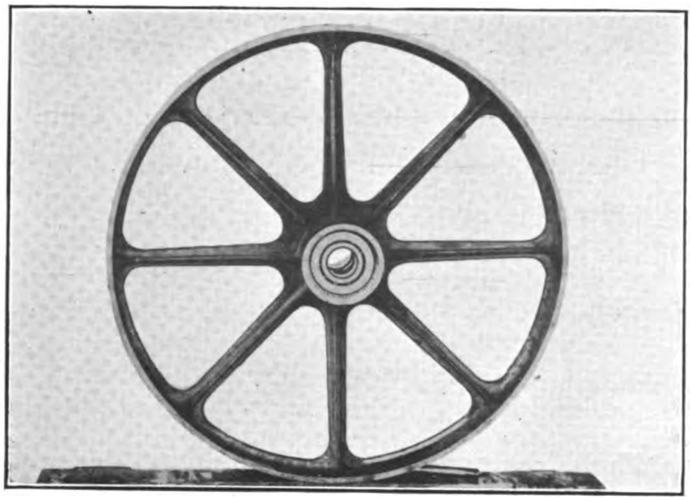
European engineers have gone more deeply into metal wheel building than have Americans and they have had the advantage of several years of experience. In England steel wheels have been used for service vehicles with a large measure of success, and in London some very large installations have this equipment throughout. The custom with most manufacturers is to give a purchaser the choice of either wooden or metal wheels. These all-metal wheels may be one of several forms or constructions. One is a solid iron or steel casting, another is a casting with hollow spokes, a third with hollow spokes and rims, a fourth is sheet steel stampings welded together, a fifth sheet steel stampings riveted together, and there may be other combinations.

Wheels of these types have been used in England for a considerable length of time. One of the faults developed by the first construction, especially those



The "Cored" Cast Steel Rear Wheel with the Brake Drum Integral, Made and Used by the A. O. Smith Company on Smith-Milwaukee Trucks.

with solid spokes, was that the spokes cracked close to the rim, probably due to the unequal expansion or casting strains, and possibly to the quality of the metal, and design was also another factor of material importance. The lack of satisfactory wood and the need of substantial construction impelled the makers to continue and today cast or stamped metal wheels are much used. In service they have been found to have greater rigidity than wood and to have from this fact a quality that appears to give greater tire service, as the wheels generally remain true and are not as likely to be "sprung" as wood, and there is a more uniform and regular movement of the tire upon the road surface. In England the custom is to bolt the brake drums to the metal wheels and there is less possibility, according to experience, of the wheels being affected by braking strains. While it is true there is



The Cast Steel Front Wheel for Delivery Wagons Made by the Sheldon Axle Company.

less elasticity than with wood, it is also true that the wheels are not affected by climatic or atmospheric changes, and the tendency of the wood members to twist and loosen is entirely eliminated.

Those who have observed metal wheels closely point out that with the solid spoke and solid rim type there is undoubted strength, but increased weight as compared with those having hollow spokes and rims, while it is maintained by some that the stamped metal wheels are less likely to crack from crystallization, and have the advantage of being hollow. It is maintained further, however, that the welded stampings are to be preferred to those assembled with rivets because there is no possibility of the members loosening the rivets from stresses and strains. The metal is not affected by heat or cold and can be protected by paint against all influences that would cause deterioration. The claim that the rigidity of the wheel causes the transmission of road shocks to the springs is met by the statement that with well lubricated bolts and shackles the springs should be equal to the absorption of any shock or stress.

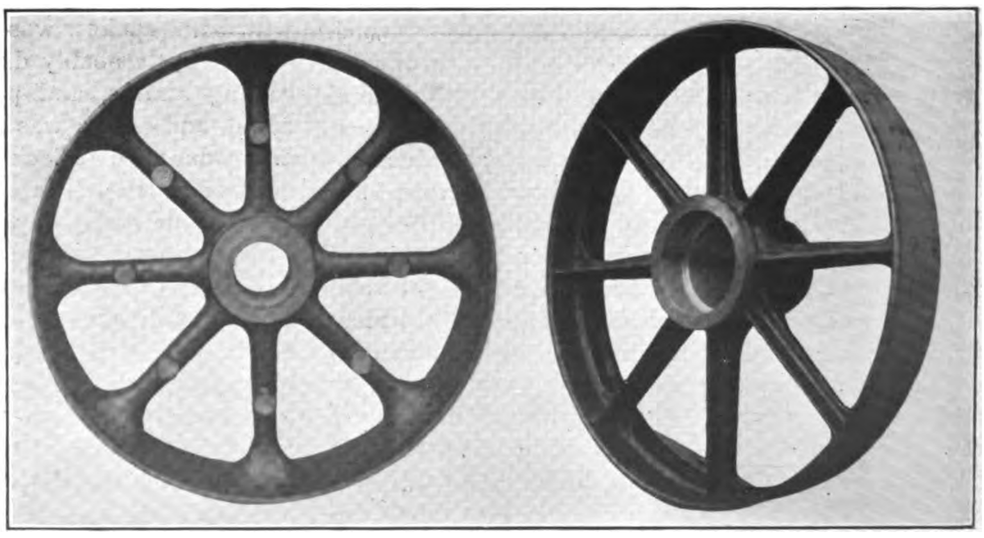
It is not possible to give data that will show the relative qualities of the different types of metal wheels used in England. So far as is known no tests have been made with a view of determining standards of dimensions.

In some instances the manufacturers of vehicles build the wheels they use, and others purchase of manufacturers who have specialized differing constructions. Admittedly there were failures of some of the wheels, but these were generally those used for experimental purposes, and in some instances because of the lack of metal.

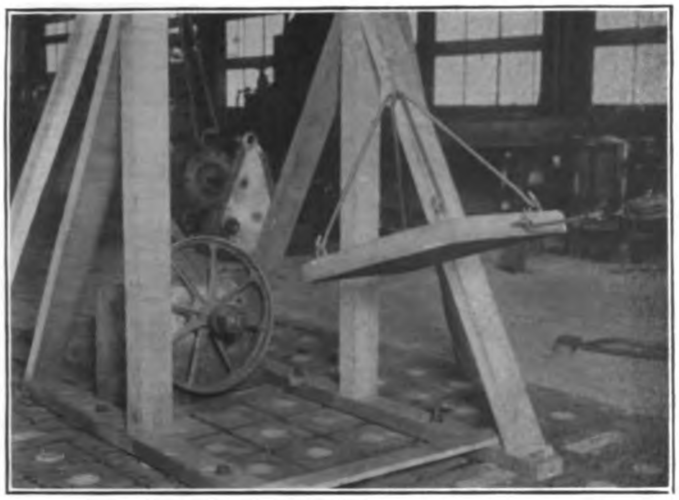
Another fault was the denting of rims from too soft material. One of the principal objections to the wheels was that when damaged it was believed necessary to replace the whole member, but this was before autogenous and electric welding had made possible a thorough repair, though there are those who maintain that breakage of the spokes close to the rim is a result of crystallization, and that after a failure from this cause a wheel ought not to be depended on.

The largest user of steel wheels in the world is the London General Omnibus Company, which has more than 2000 vehicles in service and expects to have this number increased to 5000, and one very important result, learned from exceedingly careful observation, is the increased endurance of tires. Tire cost is today one of the largest items of expense for motor vehicle operation, and any material saving will undoubtedly be welcomed, especially where the mileage is necessarily large. It is not practical, however, to measure results in London with what might be accomplished in America, for the London streets are, as a rule, decidedly superior to those of American cities, and there is a considerable difference between European and American tires. The service tire generally used in Europe has a larger cross section and contains more material, and consequently ought to wear longer than those that are manufactured in this country. However, gauged by the standard of European tires the steel wheel is maintained to be productive of greater mileage.

In this country there are five manufacturers of service vehicles that equip their machines with steel wheels. One is the White Company, which has used this form of equipment for perhaps two years. The wheels are designed by the company's engineers, and are cast in the company's foundry. These are a solid spoke type and are of different sizes for the several models of vehicles produced. The company is not willing to make public its manufacturing process. These wheels, which are standard construction, have given excellent satisfaction and are approved by the owners and operators of the machines. No data of comparative service or with regard to the endurance of the tires are found to be available.



Two Examples of the Desig n of the Cast Steel Wheels of the Sheldon Axle Company.



Sheldon Cast Steel Wheel Subjected to the Dynamic Pendulum Test Before Members of the S. A. E.

The Locomobile Company of America also equips its machines with wheels with solid spokes and rims, these being cast to designs furnished by the engineering department of the company by Isaac C. Johnson & Co., Spuyten Duyvil, N. Y., a concern noted for the high grade of its products. The statement is authorized by the company that its engineers conducted tests of both wood and steel wheels for from six to eight months to determine the relative merits, and from these experiments it was concluded that for a truck with a carrying capacity of five tons wood wheels were not reliable and did not have what was considered to be proper life. In addition to greater strength it was found practicable to reduce the weight in the steel wheels, a quality of material importance. Having reached this conclusion the company decided to build steel wheels and to use them with all vehicles produced.

The A. O. Smith Company, maker of the Smith-Milwaukee trucks, uses cast steel wheels on both its 3.5 and six-ton machines. These are a different construction than any made in this country or abroad, and are what is known to the maker as the "cored" type. The wheels are cast in the company's foundry from designs by its engineering department, and as they have been used for several years without failure or development of defect they are regarded as being in every way superior to any other equipment. In the casting the brake drums are made integral with the spokes and rims. The accompanying drawings show a rear wheel and the brake drum, and a rear wheel with the tires as it is seen on a truck, with the wheel cap bolted on. These wheels are constructed for use with a full floating rear axle, for the Smith-Milwaukee truck is driven by a shaft, worm and gear wheel.

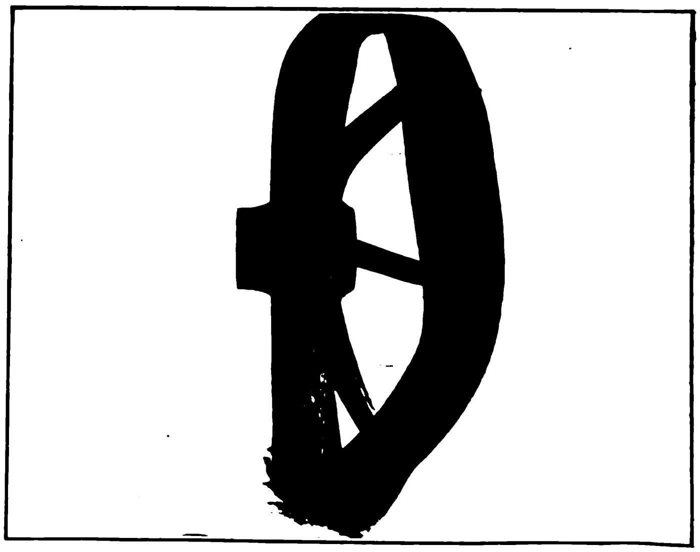
As will be noted from the drawing of the wheel without the tire, the hub and brake drum are supported by a series of eight spokes that are heavily webbed where they join the rim and the central section, and the spokes are really half-round channels in the web when seen from the inside, and have the usual half-round appearance from the outside. The semi-circular form of the spoke is continued to the rim, each being reinforced by a transverse web from the centre of the spoke to the rim, and between each spoke there is a web above the rim that really divides it longitudinally along the centre line of the spokes. The web uniting the spokes as they converge into the hub is wide and strong. Referring to the drawing without the tire, it will be seen that the spokes are each reinforced inside by a double web from the edges of the spoke channel to the rim. The form of the openings in the web of the wheel is well shown in this illustration. The rim of the wheel is cored at frequent intervals to secure lightness and to insure against casting strains. These wheels are said to average 20 pounds lighter for the front equipment for a 3.5-ton truck, and 50 pounds lighter for the rear wheel of the same vehicle, as compared with wood.

The castings are very smoothly made and are machined carefully, the rims being trued at the edges and the surfaces turned to take standard tire rims. The hubs and the brake drums are similarly machined, and when finished the wheels are balanced and have a satisfactory life and resiliency. The wheels are finished with paint or enamel and are not affected by climatic influences or changes of temperature.

Steel wheels are used by two other concerns, but these are made by others than the vehicle manufacturers.

The manufacture of steel wheels has been begun by the Sheldon Axle Company, Sharon, Penn., and this concern is now in a position to produce any sizes or types of equipment, or to make special work wherever the standard designs are not regarded as desirable. The Sheldon Axle Company is one of the largest makers of vehicle axles and springs in the world, and its manufacturing experience covers a long period. It has every facility for production, and the material used is selected with a complete knowledge of the requirements of service.

The company authorizes the statement that the construction of steel wheels was begun after careful investigation and exhaustive study of the causes of



Distortion of the Wheel by the Test, but the Casting Showed No Evidence of Fracture.

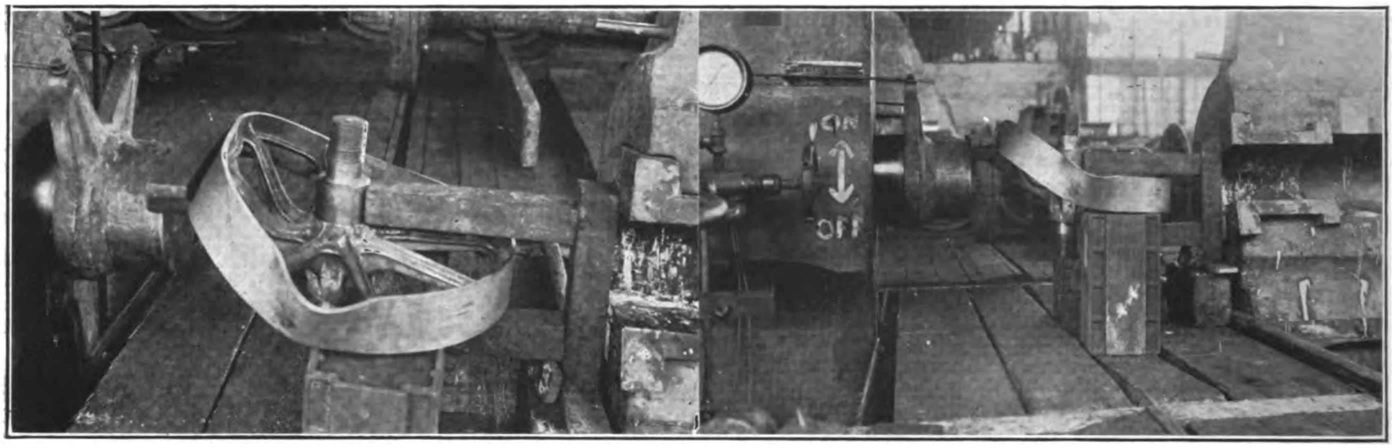
wood wheel failure, and believes that its products may be accepted as a positive solution of wheel fault. When the subject of all-metal wheels was given attention the engineering department made careful investigation and experiment, and designs were adopted that have been justified as meeting in every respect the exacting service of wagon and truck use.

The company claims that the steel wheels are superior to wood in three different respects—in stability for bad roads and rough handling, in increased strength and in economy through greater tire mileage. It is maintained that the European experience, of much trouble with wood wheels and very little with steel wheels, is conclusive proof that the steel wheel can be the better applied here than in Europe, for the roads are so much rougher and generally less improved. It is pointed out that with the large machines the wood wheel designs are constantly changed, the number and proportions of spokes being increased. In Europe some wheel builders are making laminated wood disc equipment. It is held that increasing the number of spokes is necessarily followed by the difficulty of securing them. The wheels will be subjected to extreme stresses under ordinary service, and wherever emergency arises, where it is necessary to lock the wheels with the brake, under full load or overload, continued use is eventually followed by deterioration. No conclusion has been reached as to whether or not the use of the brake is more severe on wheels than is road shock, but the change was made from wooden to steel wheels by the London General Omnibus Company because of the almost constant braking effort applied. While the omnibuses are driven under almost ideal road conditions, it is not unusual for brakes to be applied 2000 times in the course of a day. Some of the stops must be made under conditions that are exceedingly severe on the vehicles, the skidding on the paving making it necessary to protect windows, lamp posts and the like by erecting stanchions.

The combined lateral strains upon the wheel rim and the braking strain with the locked wheel causes the wooden wheel to yield and the joints to have more or less movement. The steel wheel is so efficiently ribbed that it is able to resist these stresses.

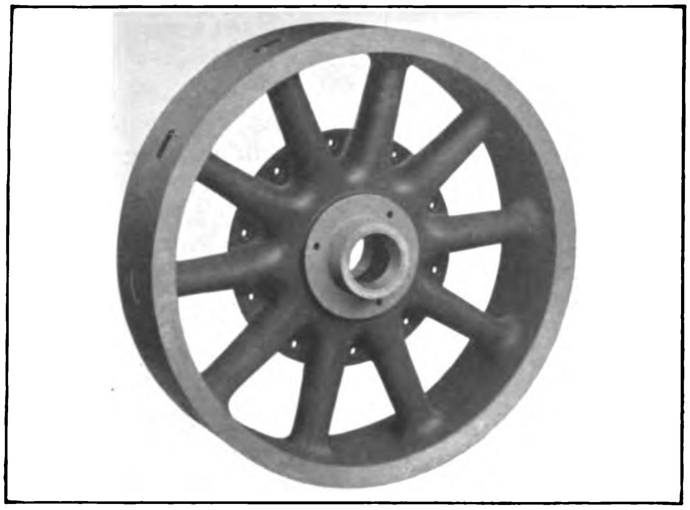
It is further maintained that the increased strength of steel as compared with wood is especially attractive to the engineer, as it gives him unbounded opportunities to materialize his deliberations in the most perfect manner known to the profession, and it is possible and practical for him to make estimates and calculations that can be thoroughly relied upon.

This may be illustrated by taking for example a steel wheel having a diameter of 40 inches, with spokes having a star cross section four inches from the centre of the hub, the section of which would be 4.75 by 2.5 inches and .4375 inch thick. The larger section, parallel to the axis of the axle, may be compared with a wood wheel hub having a three-inch square spoke. Assuming the ultimate strength of the steel at 75,000 pounds a square inch and the wood 10,000 pounds a square inch, the steel wheel would allow a pressure of 7200 pounds on the rim and the wood wheel but 2800 pounds. These figures are taken from a very successful steel wheel application weighing less than wood wheels. Obviously, the wood wheel would necessarily have more than twice the number of spokes to have the same strength from these same factors alone. As the whole load is sustained by two or three spokes when the machine is skidding, the economic disposition of the material to react on the side strains can be the better appreciated.



At Left, the Sheldon Cast Steel Wheel After Undergoing a Hydraulic Test of 25 Tons; at the Right, the Manner in Which the Pressure Was Applied.

Comparing the section moduli at the juncture of the spoke to the hub on steel wheels with wood wheels, there is no doubt of the superiority of the former with reference to strength. It is held that the star sections appear so light to American engineers that they have deemed it wise in many instances, for appearance only, to resort to other sections, such as the U or round, although the star appears to be the most economic, considering the combined driving, braking and skidding strains. The tendency of engineering practise is toward a high grade steel casting, having, for instance, an ultimate strength of approximately 75,000 pounds to the square inch, an elastic limit of 35,000 pounds to the square inch, a reduction of 40 per cent. and an elongation of 30 per cent. It is believed that



The Timken-Detroit Malleable Iron Hollow Spoke and Rim Rear Motor Truck Wheel.

these figures will be a good standard for a considerable period. These figures apply only to steel, and not to malleable iron and semi-steel constructions.

It is claimed for steel castings of the above physical properties that they can be easily forged when properly annealed, and in the event of accident a wheel can be straightened without fear of fracture, and even welded if this be necessary.

Regarding the economy of tires, which is maintained to be a very important factor in favor of steel wheels, it is claimed that there is a distinct saving with steel equipment, and that some of the largest tire manufacturers guarantee as much as 30 to 40 per cent. longer life with such wheels. The London General Omnibus Company uses 34 by four-inch single solid tires forward and 40 by four-inch dual solid tires rear, and it is claimed that the average for a set of tires is 25,000 miles, and that in one exceptional case a pair of front tires was driven approximately 50,000 miles. The omnibus chassis weighs about 6300 pounds, and it is practically built for a three-ton load, having accommodation for 16 passengers inside and 18 on the roof deck. These chassis are geared seven to one on the high speed and with the 40-inch traction wheels a speed of 30 miles can be attained, which is admitted to be about twice as fast as these machines should be driven. The guarantee of the tires would be void immediately if such excessive speed were made on solid tires in America. In addition to this is the fact that the brake is applied an average of about 2000 times daily.

The first steel wheels produced by the Sheldon Axle Company were for wagons of one and two tons capacity, the forward wheel for the ton wagon to be equipped with 34 by 3.5-inch tires. The weight of the wheel is 99 pounds. Some of these wheels were tested with a dynamic pendulum at the works of the Treadwell Engineering Company, Easton, Penn., Jan. 15, before a number of members of the Society of Automobile Engineers, for Arthur E. Laycock, chief engineer of the Sheldon Axle Company. The wheels are made of a very high grade of electric furnace steel. The result of the tests for a two-ton front wheel is given in the following:

Blow		Permanent Deflection	Total Deflection	Energy of Blow in Foot Pounds
1	36 inches	0	0	216
2	42 inches	0	0	294
3	48 inches	0.046675 inches	0.046675 inches	384
4	54 inches	0.078125 inches	0.078125 inches	485
5	60 inches	0.109375 inches	0.234375 inches	600
6	72 inches	0.203125 inches	0.0375 inches	865
7	108 inches	0.75 inches	1.1875 inches	1940
8	120 inches	0.9375 inches	2.125 inches	2400
9	144 inches	1.1875 inches	3.3121 inches	3640
10	144 inches	1. inches	4.3125 inches	2460

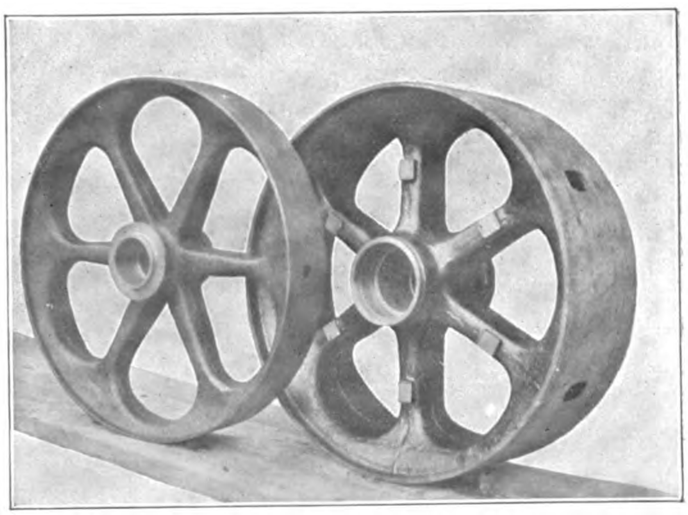
The test to which the wheel was subjected was a lateral impact at its rim with a 480-pound pendulum.

When the pendulum test was completed the bent wheel was placed in a hydraulic press and a radial load of 25 tons was applied to that portion of the wheel rim that was bent. The accompanying illustrations show the wheel before and after each test.

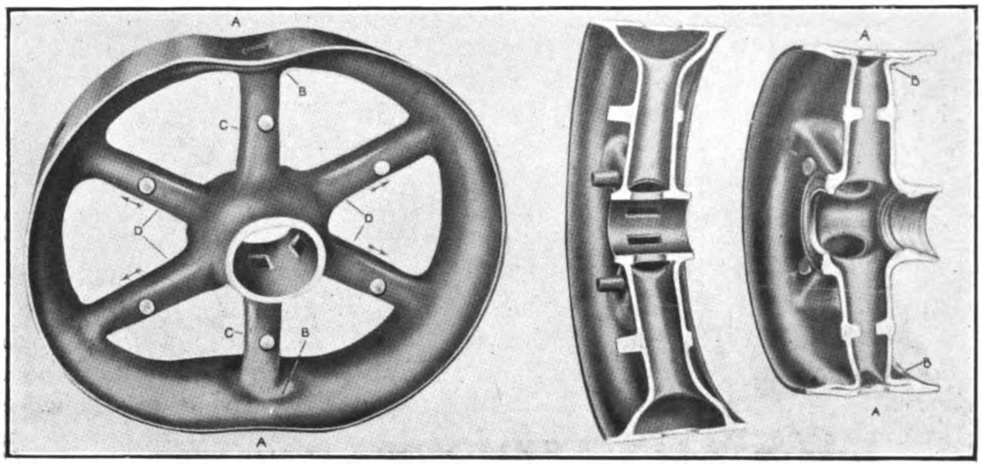
Regarding the qualities claimed for the wheels, other than those that have been stated, it is claimed that they will not warp, swell or shrink in any climate, and that the very thin metal rim and perfectly cylindrical form is an important factor in the radiation of heat. As the wheels are machined all over they are certain to be true in every respect. They will not collapse under any stress, and even should they be bent they can be restored to the original form. Because of the lighter wheels it is maintained that the vehicles can be accelerated more easily and quickly, which means fuel economy, especially when many stops are to be made. Being very resilient, the wheels will yield and will not be damaged from ordinary shocks.

From the viewpoint of the manufacturer it is held that there is an economy in a wheel that has but one part as against the 18 of a wooden wheel, or four against the 72 of a chassis, considering the bolts, nuts, flanges, hubs, rims, etc. This elimination of parts make upkeep and maintenance an easier proposition. The rim of the wheel takes the band of the tire, for the wheels are finished to the S. A. E. standard.

The Sheldon wheels have been designed with special reference to the use of axle bearings, for the fitments differ with the manufacturers, and these wheels can be fitted with the Standard Roller Bearing Company's taper roller bearings, the Bower straight roller



Forward and Rear Heavy Cast Steel Truck Wheel, Made by the George Fischer Electric Steel Works, Schaffhausen, Switzerland.



Result of Test of Fischer Wheel by Dropping a Ton Weight on It; At Left, the Spokes Telescoped into the Rim; at Centre, a Section of Wheel Showing Construction, and at Right, a Section of the Tested Wheel, the Cored Rim Being Flattened.

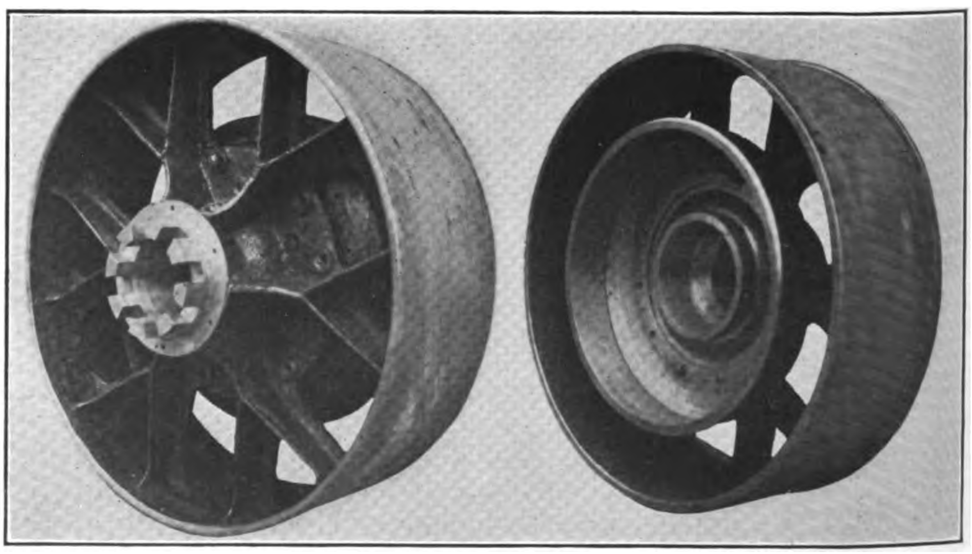
bearings, the New Departure double row annular ball bearings, all of these three makes being interchangeable in the hubs. It is also possible to use any standard double or single row annular bearing by the addition of a spacer.

The Timken-Detroit Axle Company has begun the manufacture of malleable iron wheels for service wagons, and an example of the finished product is shown in an accompanying illustration. There are no engineering data available as to the strength and endurance of these wheels as compared with wood, although the company has developed these wheels after a series of tests that has, in the minds of its engineers, thoroughly established their value. No information is given as to the manufacturing process. The company authorizes the statement that, in the opinion of its engineers, eventually the metal wheel will be generally, if not universally, adopted for service vehicle equipment. Some of the qualities which will lead to this preference are, according to the company, that they are, or soon will be, no more expensive, that they are no greater, if not less, in weight, and that they are very much stronger and neater in appearance.

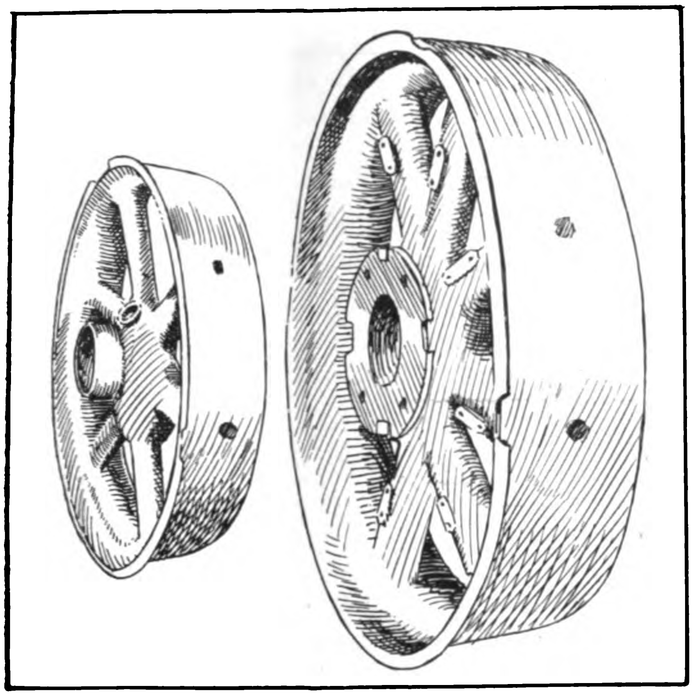
From the viewpoint of the American engineer the simplest manner to make anything of metal is to cast it, and cast iron wheels would not meet the requirements, not having the strength to resist the strains, and the metal has not the ductility that will justify its use. The Timken company's belief is that it is difficult to cast steel so that it will be homogenous and uniform throughout, and for this reason malleable iron is selected as the material that will give the greatest satisfaction, assuming, of course, that the design of the wheel is correct. It is characteristic of malleable iron that it is strongest on the surface or "skin," and the Timken-Detroit wheel is designed with the greatest surface that is possible to have, which is acplished by casting the entire wheel, hub, spokes and rim, hollow. Where the spoke joins the hub and the rim the surface of the casting is curved on an arc, which has a radius sufficient to prevent shrink cracks.

The accompanying illustration of a Timken rear wheel shows that the design appears large, the rim, spokes and hub having a large surface area, and the spokes flare at the juncture with the rim. It will be noted that the wheel is cored from the hub through the spokes to the rim, and that the hub seems to have unusual size. The flange to which the brake drum is bolted is cast integral with the hub, and this forms a web between the spokes that materially strengthens the construction. The wheel is finished by careful machining and is turned true to its axis. The hub cap is bolted on. In actual size the wheel is about the same as though it were made of wood. The wheel is a single piece and this simplifies the attention that is necessary. It may be painted and is smooth and neat. The rim being made to standard size, any tire may be fitted. The statement is made that the Timken-Detroit wheel will endure pressure from different directions much better than a wooden wheel, and under numerous comparative tests it has been proven to be sufficient for any character of truck service. The wheels are made in different sizes. Relative to manufacturing, it is stated that it is a comparatively simple process to make the malleable iron casting, to machine it to truth, and to fit the cups for the Timken bearings.

A wheel that has recently received considerable attention from American automobile engineers is the



Rear Truck Wheels of the "Y" Spoke Type, with Brake Drum Bolted to the Webs, One of the Older Fischer Constructions.



Forward and Rear Sheffield Cast Steel Wheels with Hollow Spokes and Rims, Without Tires.

Fischer steel equipment, which is a product of the George Fischer Electric Steel Works, Schaffhausen, Switzerland, for which Peter A. Frasse & Co., 417-421 Canal street, New York City, is American agent. This company is probably the pioneer in the production of steel wheels in Europe and it is claimed that it is the largest manufacturer of this product in the world. The Fischer steel wheels are used very generally in England, many of the truck makers having adopted this equipment, and among the users is the London General Omnibus Company, to which reference has been previously made.

These wheels are made in different sizes and for differing types of vehicles. In the development various forms were experimented, among these being the solid type with the plain cross section spoke and the "Y" section, but the designs that have been adopted are those with the hollow spoke and rim for four to six-ton trucks, and the solid rim and hollow spokes for the lighter vehicles. The manufacturing process has been carefully developed. The material is a comparatively low carbon steel, it being about .02 per cent., and as it is smelted in electric furnaces, where there is absolutely definite control of the temperature, the metal is of exceptional purity.

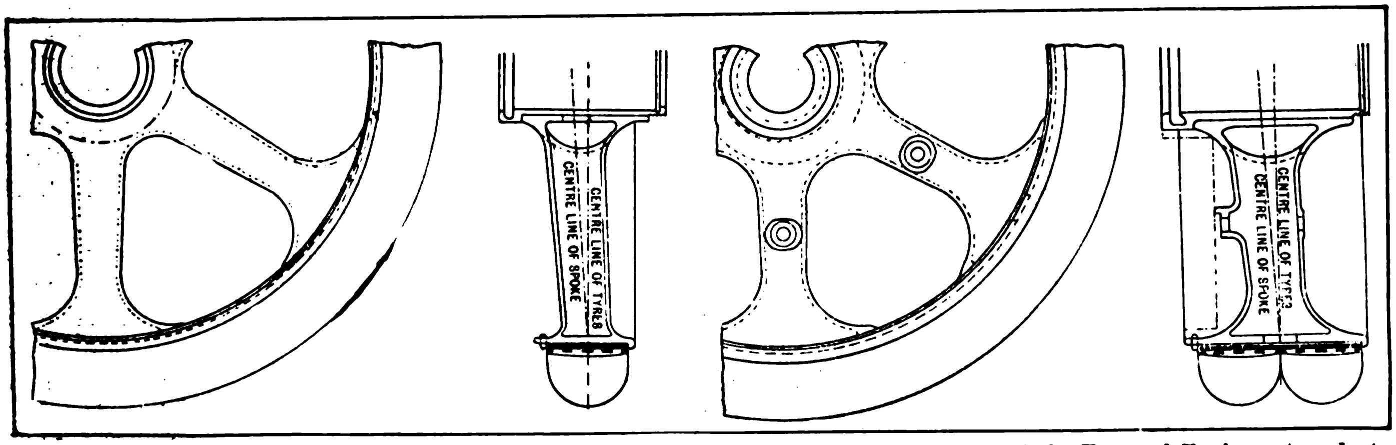
In the casting great care is taken to have the thickness of the walls of the wheel uniform, and it is approximately .4 inch, but this does not apply to the bosses and special parts of the hubs. This construction gives a very light and strong wheel, and it is smooth and pleasing in appearance. The extreme ductility of the metal makes for great strength and in the machining of the rim a spiral chip has been made 21 feet long, the actual length being very much in excess of this. The ordinary steel casting chip is comparatively small.

The strength of the wheels has been tested in different ways, but one of the most interesting was the dropping of a weight weighing a ton a height of 24 feet on a rear wheel of the hollow spoke and rim type. Four times the weight was dropped, and the result was that the outer web of the hollow rim was compressed to the inner web, and the effect was to flatten the wheel at top and bottom, bringing the walls of the rim closely in contact. But the hub and the remainder of the wheel was not changed.

The wheels made for the London General Omnibus Company are the hollow spoke and rim type, and this form is specified for the military trucks of the French, German and Italian armies. Other users are the London General Transportation Company, the Daimler Company, Leyland Motors Company, Halleys, Albion, Commer trucks, Dennis Bros., and Maudsley. The wheels built for the London General Omnibus Company are 36 inches diameter and these are fitted with four-inch single solid tires forward and four-inch dual solid tires rear. The front wheels weigh 112 pounds and the rear wheels 216 pounds. The tire equipment is not demountable, the tires being forced onto the rims under heavy pressure.

A number of truck manufacturers of America have ordered Fischer wheels for experimental purposes, and some of these are now in use, in many instances the machines used for experimental purposes being equipped with them. These wheels are of the hollow spoke and rim type.

A patent is held by a Boston company, which made

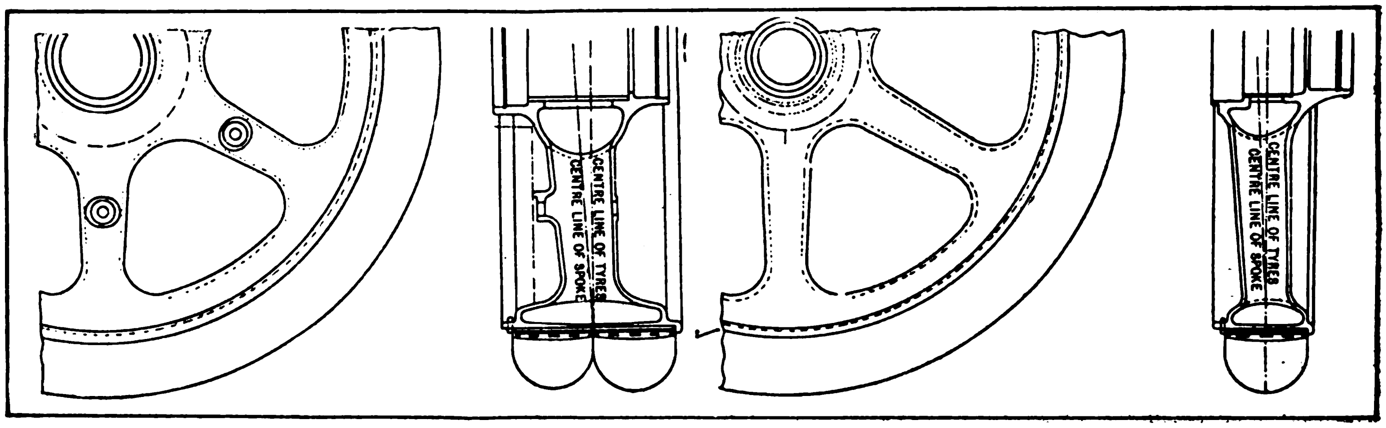


Sheffield Cast Steel Wheel, with Solid Spokes and Rim: At Left, the Side and Cross Section of the Forward Equipment, and at Right the Rear, with Dual Tire Installed.

exhibition at the 1912 service wagon show in that city, for a cast steel wheel in which the spokes are hollow and the brake drums are integral with the casting. This construction is considered by the patentee to be more advantageous than with the brake drum separate. The assembly is stated to be approximately 250 pounds lighter in a rear wheel of 36 inches diameter. A test of the metal used was made at the laboratory of the United States arsenal at Watertown, Mass., and it was found to have great strength and ductility. One test made was to drop a wheel without a tire about 15 feet onto a solid granite ledge, and after 18 tests of this kind the only damage found were dents in the rim.

Steel wheels are made commercially in England by the Sheffield Steel Castings Co., Ltd., Sheffield, and are made in two designs, the one with the spokes and rims hollow, and the other with hollow spokes and solid rims. As compared with wheels cast solid with cross section spokes, it is claimed that these wheels are considerably lighter though stronger, are more durable, are not so likely to be affected by severe vibration, they are more easily cleaned, have more resiliency and are in every way sightly. The success of the wheels in service is attributed to the special steel used and the processes of manufacture. In casting the metal is heated in an electric furnace and is subjected to special treatment before it is poured into the molds. With the hollow rim types the outer periphery of the wheel is supported by webs. After casting the wheel is machined, and this work is done to .001 inch. While the company produces these to its own designs it also furnishes work to any specification.

The accompanying sectional drawings will illustrate the construction of the Sheffield steel wheels. Both types are shown. One of these shows the side and cross section of the hollow rim form, for both front and rear wheels, and another shows the side and cross sections for front and rear wheels of the solid rim pattern. In all cases the drawings illustrate tires on the wheels, this giving a better idea of the design. A front and rear wheel of the hollow rim type is also illustrated. The wheels have been sold in the market for upwards of two years and have been supplied to a number of British vehicle manufacturers.



Sheffield Cast Steel Wheel with Hollow Spokes and Rim: At Left, the Side and Cross Section of the Rear Member, and at the Right the Rear Equipment.

INCREASES CAPITAL STOCK.

Motor Foundry Company to Enlarge Capacity for Producing Engine Castings.

Stockholders of the Motor Foundry Company, Detroit, at the annual meeting, gave approval to the plan for increasing the company's capital from $35,000 to $100,000 to provide funds for extensions of the plant necessitated by enlarged business. The additional capital has been fully paid in and work has begun on the erection of new buildings adjoining the present plant, which covers 2.5 acres on Hart avenue. The company employs 265 men and has a melting capacity of 40 to 50 tons of iron a day. Completion of the additions will increase the capacity to 80 tons a day.

The plant is one of the largest gray iron foundries in the country producing exclusively castings for gasoline motors. The officers are: President and general manager, J. H. James; vice president, E. A. Nelson; secretary and treasurer, L. H. Green. The active management of the company is in the hands of Mr. James and Mr. Green, both young men of wide experience as foundrymen in iron, steel and malleable iron castings.

TO LOCATE IN NASHVILLE.

Evans Motor Car Company to Manufacture Commercial Vehicles in New Plant.

The Evans Motor Car Company of Nashville has been chartered at Nashville, Tenn., with capital stock of $50,000 to manufacture commercial motor vehicles and the Evans gas engine. The incorporators are: Everett Philpot, George R. Anthony, Howell Brandon, Clarence Woodcock, A. P. Foster and R. H. Evans.

The concern will take over the business of the Automobile Manufacturing & Engineering Company of Detroit, in which Mr. Evans is interested. It is the intention of the company to locate the factory five miles from Nashville on the Gallatin pike. It is planned to manufacture 500 cars the first year and later to increase the capital stock to $200,000. The plant will eventually employ 600 to 1000 men.

LEGISLATION--DEFEATED AND PENDING.

THE owners of motor service wagons in Rhode Island were successful in their opposition to the bill, pending in the General Assembly, that purposed to tax all machines used for business purposes $20 for one ton capacity or less, and $10 for each additional ton capacity or fraction thereof. The bill was introduced into the senate at the request of the board of public roads, and was passed without a public hearing, at least such hearing as was known to the public by advertisement. It went to the house and there was referred to the committee on the judiciary, and without an advertised hearing it was favorably reported to the house for concurrent action.

When the bill was before the committee, just before the house was called to order, request was made the committee to give a hearing, and the members consented to hear those opposed to the bill when a petition was presented signed by some of the large manufacturing interests of the state. Those particularly active in opposing the bill were instrumental in calling a meeting of the truck owners of Rhode Island, which was held in the Providence salesrooms of the Packard Motor Car Company, and was presided over by John D. Turner, superintendent for the Seaconnet Coal Company.

At this meeting, which was largely attended, explanation was made of the situation, and the necessity of immediate and united action urged. The statement was made that the motor vehicles were taxed to the full valuation by the city, that wherever changes had been made for the purpose of housing the machines the value of the property had been materially increased, and further, the greater part of the use of the vehicles was on the streets of the cities and not on the state roads. It was maintained that there would be one of two results from the taxation: That the use of motor vehicles would be given over by some, and there would be a retardation of the utility of such means of transportation, or the people would be required to eventually pay the increased cost.

At the meeting were representatives of large manufacturing interests, coal companies, ice companies, breweries, truckmen, and those having large volume of haulage, and it was stated that it was the intention to have a permanent organization which would systematically promote every interest having to do with vehicular transportation.

At the request of those present, William W. Scott of MOTOR TRUCK, who is actively concerned in state legislation, explained that the present registration fee of $2 a service wagon was established when the bill was before the legislative committee through representations made to the committee, and it was then the unanimous opinion that a vehicle used for business purposes was not destructive of the highways and that they were fully taxed. That committee had not hesitated to place what was then, and is now, as heavy a tax on pleasure cars as it was believed the owners would pay, but it did decide that to tax a business vehicle was unreasonable and unjust. He also showed that the cities of the state pay more than 85 per cent. of the state tax, and consequently that proportion of the state expenditure for highways and their maintenance, although not an inch of state road is in the cities, and that taxation of the motor trucks, practically all owned and used in the cities, was an endeavor to benefit the towns at the expense of the cities.

The meeting appointed a committee to appear before the legislative committee, and a committee to secure signatures to an organization agreement. The committee on legislative action was heard the following day by the committee, its endeavors being supplemented by a number of attorneys representing the American Locomotive Company and other interests. The committee finally stated that as the measure came from the state board of public roads the remonstrants should appear before that body. The following day the committee and the lawyers appeared before the state board, which admitted the bill was solely intended to produce revenue, and reiterated the remonstrances. The result was that the bill was withheld by the committee and was not reported. One reason for this was the fact that there is to be a special election in the state early in June to authorize an issue of bonds for the improvement of the state highways, and there is no doubt that the influence of the owners of the 1000 or more motor vehicles in the state could be exerted to defeat the proposal to issue bonds, especially when the apathy of people in special elections is realized.

The failure to report the bill ended the attempt to tax motor wagons in Rhode Island, for the year of 1913, at least. Meantime the owners of such vehicles are proceeding with the organization and will be prepared for any further attempts of the kind.

In Massachusetts the bill indorsed by the state highway commission, which proposed to tax motor wagons $5 a ton capacity or fraction thereof, which was before the committee on roads and bridges, and had been recommended as a substitute for a bill that had been agreed upon by the highway commission and representatives of motor wagon owners which comprehended a tax of $5 for the first ton and $2.50 for each additional ton or fraction thereof, is now pending before that committee, having been recommitted to it at the request of hundreds of interests as represented by petition. The bill was proposed by the state highway commission. It is avowedly a measure for the purpose of increasing the revenue that the commission can expend on highways, and as there are now approximately 5000 service vehicles in the state, and this number is rapidly increasing, there is little doubt that the bill would yield at least $100,000 the first year. The bill also proposes to limit the weight of machines to 12 tons when loaded.

A meeting of truck owners, the Boston Commercial Motor Vehicle Association and differing organiza-

tions having direct interests, as well as labor federations, was held in Boston April 24, at which a systematic campaign was begun to defeat the bill, if possible. It was stated that the state highway commission had not kept faith with those with whom a compromise bill was agreed upon, and for that reason the associations which had consented to the compromise did not feel bound to support the measure in any manner. Committees were appointed to carry on the campaigning, and it was agreed to direct endeavor toward all members of the legislature, as well as the committee.

The legal phase of the remonstrance was left with James B. Sullivan, Jr., counsel for the Boston Commercial Motor Vehicle Association, he to make the plans for the hearing to be given the remonstrants by the committee May 6, and it was decided to have the large business interests represented so far as possible by owners and users of machines. Acting in concert with the owners is the Automobile Legal Association, the Automobile Owners' Association, the Electric Motor Car Club of Boston, the Electric Vehicle Association of America, and the several motor vehicle manufacturing companies of Massachusetts. Besides these a number of the large makers of machines located outside of the state, but doing business in it, and representing many thousands of dollars invested in branches and service stations, united with the committee of owners.

It was pointed out to this meeting that there were many concerns in Massachusetts doing business in other states, and concerns in other states doing business in Massachusetts. The outside enterprises were taxed in their own states, and to heavily tax them for the use of vehicles in Massachusetts would undoubtedly result in the enactment of retaliatory legislation that would still further increase the burden upon the owners of motor service wagons.

The committee on May 6 listened to the arguments made in behalf of the remonstrants to the bill and received a petition of more than 1500 names from men whose employment might be seriously affected by the enactment of the proposed bill. The bill was favored by a single individual, who said that he appeared as a private citizen, and his argument was that motor trucks should be made to pay for the maintenance of highways used by them. Incidentally, it should be stated that the members of the committee had been taken over some of the roads of the state, assumedly under the direction of the state highway commission, to get a knowledge of the conditions that were urged to justify the bill.

It was developed at the hearing that the state highway commission has jurisdiction over but seven per cent. of the roads of the commonwealth, and it was maintained that there was no statement showing the wear resulting from horse wagon traffic, which is many times the volume of motor wagons. Of the speakers was Lewis R. Speare, former president of the American Automobile Association, the owner of six trucks, who pointed out that if there was to be a tax for the use of the highways, this tax should be paid by all users. Treasurer and Chief Counsel W. A. Thibodeau of the Automobile Legal Association maintained that the proposed tax was unjust and unconstitutional; that the Illinois supreme court had declared a similar law unconstitutional, and that in New Jersey, where the question of constitutionality was raised, the supreme court had implied that to impose a tax greater than was necessary to maintain a department for motor vehicle registration was not constitutional. Other aspects were touched upon by different speakers.

The purpose of the remonstrants is to leave nothing undone that will in any way bring about the withholding of the bill, and from the large interests protesting against its enactment and with the fact that but one individual besides the state highway commission favored it, it is not improbable that the measure will not be reported favorably. If it is reported with a recommendation of passage there will be a contest on the floor of the house.

In New York the Automobile Dealers' Association conducted a campaign against the passage of the bills pending before the legislature of that state through personal effort and by letter to differing interests and to the members of the legislature, and in this work directed its endeavors along lines that were determined by practically every industrial, trade or promotive organization in the state.

The National Association of Automobile Manufacturers, through its department of publicity, has directed the attention of every industrial and trade organization in Massachusetts, Rhode Island, New York and Pennsylvania to the pendency of the bills and the probable result from enactment, and has supplied much valuable information relative to legislators, that they might be reached by those who desired to make protest against the measures. The commercial vehicle committee of the association closely observed the progress of the legislation and informed all interested relative to such influences as are wise to counteract.

In New York the legislature before adjournment amended the bill relating to automobile registration, but there was no change made in the fee charged for registering service vehicles. In Pennsylvania it is believed very probable that the proposed bill will be enacted before the session is adjourned.

In Indianapolis the Hoosier Motor Club has obtained a temporary injunction against the city which prohibits the enforcement of an ordinance levying a tax on automobile vehicles until the final hearing of a suit instituted by the club to determine the validity of the ordinance. The Indiana legislature recently passed a law providing for a graded license tax on automobile vehicles and that the proceeds of the tax shall be used on the roads of the state. The ordinance does not provide for the use of the proceeds of the tax on the streets. It is maintained by the club that one tax is sufficient, and the objection is chiefly on the ground of double taxation.

NEW YORK CITY'S PROPOSED WHEEL TAX.

THERE is now pending before the board of aldermen of New York City an ordinance introduced by President McAneny of the borough of Manhattan, which, if passed, will impose a wheel tax upon every vehicle owned in New York or which is driven upon the streets of that city. This ordinance proposes to regulate the width of tires, wheel loads and width of vehicles by the issuance of licenses by the bureau of license, this bureau being authorized to issue licenses and permits, to collect fees and to employ the necessary clerks and inspectors and weighing stations. Under the ordinance the licenses shall be issued annually. It is provided that any vehicle carrying or intended to carry a total gross load of 6000 pounds or less upon any wheel shall be charged the following annual license fees, per vehicle, based on the load in pounds per inch width of tires: 750 pounds or less, $1; 751 to 800 pounds, $3; 801 to 850 pounds, $6; 851 to 900 pounds, $12; 901 to 950 pounds, $25; 951 but not to exceed 1000 pounds, $50.

In addition to the above fees further fees shall be charged for loads greater than 6000 pounds, but not to exceed 10,000 pounds, upon any wheel, as follows: 6001 to 6500, $75; 6501 to 7000, $110; 7001 to 7500, $150; 7501 to 8000, $200; 8001 to 8500, $300; 8501 to 9000, $500; 9001 to 9500, $750; 9500 and not to exceed 10,000, $1000. For loads greater than 10,000 pounds per wheel, license fees shall be charged for each vehicle at the additional rate of $500 for each 1000 pounds increase in weight, or portion thereof per wheel, provided, however, that no greater weight than 1000 pounds per inch width of wheel shall in any case be permitted except under a separate clause, special permits for single trips can be issued at fees of not less than 10 per cent. of the annual fee, and no permit fee shall be less than $25, where the load is more than 6000 pounds or more on any wheel. Vehicles more than 78 inches in width shall be charged the following license fees for each inch in excess of that width: 78 to 84 inches, $5 an inch; 84 to 90 inches, $10 an inch; 90 to 96 inches, $15 an inch; 96 to 102 inches, $20 an inch; 102 to 114 inches, maximum width permitted, $25 an inch. It is provided that any fraction of an inch shall be regarded as a full inch, and that no load, rigging, harness or other equipment shall be permitted to extend beyond the width of the vehicle. Special permits for excess width for a single trip may be granted by the payment of a fee of not less than $10. The ordinance provides that plates in duplicate stating the weight of the vehicle empty and the maximum capacity loaded per inch of tire and per most heavily loaded wheel and width overall shall be furnished by the city upon payment of the license fee, and shall be permanently attached in a conspicuous place on each side of the vehicle. The ordinance also provides for weighing stations in such numbers and at such places as may be determined by the board of estimate and apportionment upon recommendation of the chief of the bureau of licenses, and all vehicles shall be weighed at such weighing stations as often as may be required by an authorized representative of the bureau of licenses. Violations of the ordinance may result in revocation of license, the owner may be deemed guilty of a misdemeanor, and upon conviction be fined not less than $100 nor more than $500, and in default of payment be committed to prison for not exceeding 10 days.

Under the provisions of the ordinance any vehicle, animal or motor, carrying 6000 pounds upon any wheel, which has a weight of less than 750 pounds per inch width of tire, shall pay a fee of $1, and as the weight is increased to 1000 pounds per inch width, which is the maximum, the fee is increased. It will be seen that this classification would include trucks of practically all sizes at the minimum fee, for the width of tire is such that the weight under the largest load is seldom in excess of 600 pounds an inch of tire width, but with the increase of capacity the weight on the rear wheels is often 70 per cent. of the weight of the machine and load and the weight on the rear wheels would be the basis on which the ordinance tax would be levied. With a very large number of motor trucks of capacity from five to 10 tons the weight on each rear wheel may range as high as 11,000 pounds, and yet, with a 14-inch tire and a load of 11,000 pounds this would be but 785 pounds to the inch of width. Such a load would be prohibited by the ordinance because of the weight per wheel, but it would be 215 pounds less than the maximum load per inch of tire width.

It is impossible to analyze the innumerable phases that might result in the limited space available, but it is obvious that the ordinance, while considering and licensing surface pressure, prohibits the use of larger vehicles, having rubber tires, that cannot be regarded from any point of view of having the destructiveness of iron or steel tires.

The Motor Truck Club of New York has been conducting a very vigorous campaign against the passage of the ordinance, and in this it has the co-operation of the Society of Automobile Engineers, the Automobile Dealers' Association and differing bodies of owners of horse vehicles. At the April meeting of the club Charles Emerson Gregory, consulting engineer of the borough of Manhattan and secretary of the board of consulting engineers of the city, was present to explain to the club some phases of the measure and what it was intended to accomplish. Mr. Gregory stated very frankly that it was intended to increase the revenue of the city and that the receipts of the license bureau would go to the general fund and not to the improvement of streets; that the streets of the city were not enduring under the constantly increasing traffic, and that it was believed best to limit the weights with a view of protecting the streets so far as possible; that the limitation of width of vehicles was intended to facilitate traffic. He answered vary-

ing questions from the viewpoint of the board he represented and it was developed that the streets were very generally not constructed for the heavy traffic. It was necessary to either prohibit excessive weights or to make those using the heavy vehicles pay for the use of the streets.

In the discussion it was developed that the engineers who were responsible for the ordinance had a very vague knowledge of rubber tires and their influence upon paving, and statements were made relative to the use of such tires that evidenced there had been no consideration of the difference between the rubber tire of the motor truck and the steel tire of the animal vehicle. In other words, it was proposed to tax motor trucks on the theory that they were as destructive of paved streets as are steel tires. That a rubber tire will have a contact area of sufficient size to reduce the actual surface pressure to a very small part of what was allowed for steel tires by the ordinance, was apparently lost sight of.

The fact was pointed out by J. S. Bernstein, a traffic engineer, that the ordinance was based on the assumed destructive influence of all vehicles on the streets, but the ordinance would permit this destruction to go on by the payment of additional fees, instead of prohibiting it; that the improvement of traffic was possible by better regulation and the elimination from the streets of standing vehicles; that it would be possible to have haulage done at night instead of by day; that certain streets could be set aside for differing forms of traffic; and, finally, that there was not only no knowledge of the influence of travel on the streets, but the city evidently proposed to continue to construct streets that were not suited for the heavy work upon them.

The ordinance was discussed to considerable length and from differing aspects by the members of the club, and it was the unanimous opinion that were it to become operative it would be a very great obstacle to the utilization of motor trucks, and with some it would be prohibitive, for one of the greatest economies from their use is the loads that can be carried. It was stated that the club had asked for a hearing on the ordinance and had enlisted other organizations to campaign against its adoption. The differing bodies were very anxious to prevent it becoming a city law, and were united in their opposition. In connection with this it was pointed out that such an ordinance might result in retaliatory ordinances in the adjacent towns and cities, and there might be additional burdens placed upon the owners.

At Omaha the postmaster is experimenting with the collection of the mail by motor car, and in comparison with horses the work is accomplished in about half the time. The routes range from a quarter mile to four miles length, and in trials with light machines there was but little gain made with the long as compared with the short runs, the average being practically the same.

OLD OFFICERS ARE CHOSEN.

Boston Commercial Motor Vehicle Association Re-Elects Its Board of Executives.

The members of the Boston Commercial Motor Vehicle Association were so well satisfied with the old officers that they were re-elected at the annual meeting of the organization held April 19. The only change was necessitated by the retirement of Kenneth M. Blake, for a number of years manager of the Boston branch of the Locomobile Company of America, who resigned that position to associate himself with the International Motor Company at its New York office. Mr. Blake had been a director from the organization of the association. His place was filled by C. P. Rockwell, manager of the Thomas B. Jeffery Company, maker of the Jeffery delivery wagons. The election resulted as follows:

President, J. S. Hathaway, manager of the Boston branch of the White Company; vice president, J. W. Maguire, president of the J. W. Maguire Company, agent for the Pierce-Arrow trucks; treasurer, Day Baker, New England district manager for the General Vehicle Company; clerk, Chester I. Campbell; directors, Alvan T. Fuller, president of the Packard Motor Car Company of Boston; E. A. Gilmore, of the Whitten-Gilmore Company, agent for the Federal wagons and Standard trucks for New England; J. H. MacAlman, of J. H. MacAlman & Co., agent for the Stearns truck; A. P. Underhill, of the Underhill Company, agent for the Knox gasoline and Grinnell electric vehicles; J. W. Bowman, of the J. W. Bowman Company, agent for the Waverley electric wagons and trucks, and C. P. Rockwell, of the Thomas B. Jeffery Company.

SECURES PITTSBURG PLANT.

Model Gas Engine Works to Enlarge Its Present Facilities by Adding Another Factory.

The Model Gas Engine Works, Peru, Ind., maker of gasoline engines, for automobiles, tractor engines, clutches and transmissions, has purchased four acres of land fronting on the railroads at Pittsburg, Penn., and a factory will be built to cost $200,000, and to be in operation Sept. 1. The Peru plant will be operated as formerly and there will be little change in the company's organization except that men of considerable wealth will be added to the directorate and the capital will be increased to $750,000.

The Peru concern is of long standing and having outgrown capacity, labor supply and railroad facilities at Peru, decided to establish the second plant at Pittsburg. Within three or four years extensions that will aggregate $500,000 will be made and the number of employees will be doubled. The new company will be incorporated under the laws of Pennsylvania, the name being the Pittsburg Model Engine Company.

INDUSTRY PROTESTS AGAINST TARIFF.

A COMMITTEE consisting of John N. Willys, president of the Willys-Overland Company; W. C. Leland, general manager of the Cadillac Motor Car Company; Charles Clifton, treasurer of the Pierce-Arrow Motor Car Company; Hugh Chalmers, president of the Chalmers Motor Car Company, and Henry B. Joy, president of the Packard Motor Car Company, representing 27 different concerns manufacturing pleasure cars and service wagons, has in charge a very strenuous protest that is raised to the passage by Congress of the Underwood bill revising the tariff in the form that it now has with reference to the automobile industry.

This group of manufacturers includes the Autocar Company, Philadelphia, Penn.; American Locomotive Company, New York City; American Motors Company, Indianapolis, Ind.; Chalmers Motor Company, Detroit; Cadillac Motor Car Company, Detroit; Cole Motor Car Company, Indianapolis, Ind.; Garford Company, Elyria, O.; Haynes Automobile Company, Kokomo, Ind.; Hupp Motor Car Company, Detroit; Locomobile Company of America, Bridgeport, Conn.; Kissel Motor Car Company, Hartford, Wis.; Lozier Motor Company, Detroit; Mitchell-Lewis Company, Racine, Wis.; National Motor Vehicle Company, Indianapolis, Ind.; Oakland Motor Car Company, Pontiac, Mich.; Olds Motor Works, Lansing, Mich.; Packard Motor Car Company, Detroit; Peerless Motor Car Company, Cleveland, O.; Pierce-Arrow Motor Car Company, Buffalo, N. Y.; Pope Manufacturing Company, Hartford, Conn.; Reo Motor Car Company, Lansing, Mich.; Staver Carriage Company, Chicago, Ill.; Stevens-Duryea Company, Chicopee Falls, Mass.; Studebaker Corporation, South Bend, Ind.; Warren Motor Car Company, Detroit; White Company, Cleveland, O.; Willys-Overland Company, Toledo, O.

In the Underwood tariff bill finished automobiles and automobile bodies are to be subject to a customs duty of 45 per cent., which is the same as they are taxed for import by the Payne-Aldrich tariff now in effect, but the Underwood bill establishes the tax on automobile chassis at 30 per cent. and finished parts of automobiles, not including tires, at 20 per cent., both of which were taxed at 45 per cent. by the present tariff.

It is maintained that the proposed bill, because of the reduction on the two classifications stated, is opening the American market to foreign manufacturers and foreign workmen at the lowest possible terms; that the importers and representatives of foreign automobiles were consulted and their advice taken, but the American manufacturers were in every way ignored.

It is further maintained that at the hearing before the ways and means committee of Congress representation was made by Charles H. Sherrill, representing the American Importers' Salon, that only slight modification of the existing tariff was necessary to be entirely satisfactory to European factories. (See tariff hearings, 60th Congress, schedule C, part two, pages 2659-2717.) Mr. Sherrill stated that the duty should be reduced from 45 per cent. to 30 to 33 per cent. to give the European manufacturers entry into the American market at a rate of profit that would be satisfactory. In addition, a plea was made for similar reduction by the Italian Chamber of Commerce of New York City.

The duty on finished automobiles is not reduced, but the word "chassis" at 30 per cent., means a reduction of 33 per cent. Abroad machines are generally sold without bodies, each purchaser as a rule having his equipment built to meet his own ideas. There are other factors than the choice of the buyers that entail this policy. The European automobile builder has practically completed his production in the chassis. There are those who will undertake to furnish the body and equipment, but this business is not regarded as being essential to motor vehicle manufacturing. It is this condition or aspect that has caused the protest from the American industry. Under the provisions of the bill the foreign chassis, which represents to the industry abroad what the completed vehicle does here, could be sold here for a price that would make such competition felt very keenly with reference to the higher grades of machines. To illustrate: A machine that would sell in England, for instance, for $3000, would cost here today with the duty added, exclusive of freight, $4350. Under the proposed tariff this price would be reduced to $3900. The European manufacturer could sell for the same price as now, the importer would make the same profit, and the machine could be sold at $450 less and naturally at a parity with American automobiles of the same market value.

Taking the parts clause: Assuming that the components of a chassis that would sell for $3000 abroad when assembled were shipped to this country in quantities and assembled here, the difference of 25 per cent. would mean that assembling plants for foreign machines could, and no doubt would, be established here, and the difference in price would mean a distinct selling advantage. It is claimed that this section of the tariff would encourage the establishment of American assembling plants for foreign automobiles, and that the only chassis imported would be those of the manufacturers who have not the resources to assemble their machines here, or by the occasional purchaser who bought his vehicle abroad. One handicap to foreign competition is the difficulty of obtaining parts and the same character of service given by American automobile manufacturers to their customers. Now it is necessary for the importer of motor cars to keep a stock of components to meet requirements of normal wear and use. Were assembling plants established this would place the foreign manufacturers on precisely the same footing as the Americans so far as obtaining parts and service is concerned.

American automobiles have practical worth and utility that is recognized abroad, and the exportations

have increased very largely. These markets have been developed at enormous cost and furnish an outlet for a considerable proportion of the production of some concerns. Whatever development the industry has made of the foreign markets has directly benefited the American wage earners. American productions have to combat popular opinion and in some instances strong prejudice in Europe. In America there is a prevailing sentiment that the foreign production is superior or has greater value. What is feared by the industry is that the experience with all other classes of imports will be repeated with automobiles, and, in the final analysis, the people as a whole must pay the price. The theory that the cost falls on the purchaser alone is absolutely without foundation.

MAGNALIUM MOTOR PARTS.

Different Experiments Show Great Endurance of a Very Light Aluminum Alloy.

Considerable attention has of late been directed toward magnalium, an aluminum alloy that has high resistance to corrosion, and is lighter, stronger and easier to work than aluminum. Different tests have been made and the results of these appear to indicate that the metal has met the requirements for strength and endurance, showing no evidences of wear under conditions of extreme stress. A paper was recently read before the Society of Automobile Engineers, Metropolitan Section, by Morris R. Machol, on the subject of "Lightweight Reciprocating Parts for Motors," in which the use of magnalium, an alloy of aluminum and magnesium, was reviewed. The specific gravity of magnalium is 2.5, as compared with 2.56 for pure aluminum, 2.82 for aluminum alloy No. 12, and 7.5 for cast iron. This metal has been used for cylinders and with iron pistons and has endured in engine work with a surprising degree of satisfaction, and it is maintained that magnalium pistons ought to similarly endure in cast iron cylinders.

The ordinary grade of cast iron used for pistons has tensile strength from 18,000 to 20,000 pounds, and magnalium has tensile strength of about 23,000 pounds the square inch and is very tough, the brittle quality of cast iron being lacking. Magnalium is held to be a better bearing metal than bronze or babbitt. For piston material an advantage is the reduction of vibration. While the melting temperature of the metal is 1250 degrees Fahrenheit at atmospheric pressure, and this heat is often exceeded in an engine cylinder, the magnalium piston is held to endure because it never reaches a critical point, the heat being radiated to the cylinder walls because the thermal conductivity of magnalium is 14 times as great as cast iron. As the dome of the magnalium piston is cooler than that of a cast iron piston the probability of preignition is minimized.

As the influence of the inertia forces can be reduced by using light weight pistons, the bearing friction is correspondingly reduced, and this means an increase of horsepower. The use of magnalium pistons is maintained to lessen the stress on the connecting rods and reduces the wear on the connecting rod bearings, and, indirectly, on the crankshaft bearings. The quality of the magnalium will permit the making of the wrist-pin bearings in the pistons, this construction insuring very good results. The light magnalium piston permits rapid acceleration of the engine. Where magnalium has been used for connecting rods the metal was machined for bearings and the rods have endured quite as well as where other types of bearings were fitted.

AUTO 'BUS LINES FOR NEW YORK.

Legislation Enacted That Will Allow Their Establishment in the Metropolis.

For a number of years the people of New York have been denied transportation in the metropolis other than that afforded by the elevated and surface roads and the subways save in Fifth avenue, where the motor coaches have done a very satisfactory and lucrative business. The law just amended provided that it was necessary for any company proposing to serve the public to have the consent of a company having a franchise if the route was to be in a street where a track of a traction company was laid for 1000 feet or more. The application of a company that proposed to give the public the benefit of a motor omnibus service, filed with the bureau of franchise, directed the attention of the New York board of estimate to the law and remedial legislation was formulated and was passed.

The amended law provides that omnibus lines shall have the same standing as traction companies and places them under the jurisdiction of the board of estimate of the city and the state public service commission, and these bodies are authorized to establish routes and to grant limited term franchises for the operation of omnibuses. The amendment was opposed by the New York City Railways Company and the Brooklyn Rapid Transit Company, it being maintained that the omnibus lines would carry a considerable part of the profitable short haul passengers and the unprofitable long haul passengers would be left for the traction companies. The necessity of relieving congested traffic was the principal argument in behalf of the measure.

The passage of this bill makes practical, and probably possible, the establishment of at least several companies which have sought franchises to operate omnibus lines, and one of these proposes to utilize 1000 passenger vehicles if it is given the authority to do so. There is now a company that has been seeking a franchise for a considerable length of time that desires to establish a service in Fifth avenue and proposes to utilize electric vehicles. This company promises that with the granting of a franchise it will immediately procure equipment and can begin service within a comparatively short time.

THE REASONS FOR ELECTRICS.

Conclusions of an English Writer for the Rapid Increase of This Class of Vehicle.

That there are approximately 30,000 electric vehicles in service in the United States, of which a third are used for freight and the remainder for pleasure, is the subject of a very interesting review by a writer in the Commercial Motor, one of the leading English publications devoted to highway transportation. It is maintained by this authority that about 4000 machines were produced in 1912 and that at least 5000 will be built in 1913. Considering these facts it is deduced that either England is slow to adopt a means for carrying freight that has been proven practicable elsewhere, or the conditions in England are not favorable for this type of machine.

Reflecting upon factors, it is believed that the roads of England are better and that electrics could be more economically used, while it is held that there are abundant facilities for constructing machines and there are those who would consider electric haulage were there a reasonable return on the investment. One conclusion is that the electric is only serviceable for the short hauls, and that it is most generally used where the work is short haulage and frequent stops in the United States. It is stated that electrics in the United States have not taken the place of gasoline conveyances, but have replaced horses. One of the reasons for horse replacement is held to be the severe winters and torrid summers of the United States, which "makes horse traction almost impossible," in support of which is cited the loss of animals because of the extreme heat of the early summer of 1911. It is further commented that many of the first cars built in Amercia were electric, "as the adaptation of a good electric motor in the last decade was easier than coaxing an unruly petrol motor." The limitations of the early batteries and the improvements made in them are instanced.

It is observed that with the betterment of the batteries attention was directed toward making the operation of electric vehicles commercial possibilities, the chief qualities of the machines being silence, simplicity of operation and low cost of tires, which was supplemented by the manufacturing companies establishing service stations where attention was promotive of general use. But regarding the promotion of the electric power wagon, it is stated that these were preferred by some because of the absence of vibration and odor of gasoline vehicles; that with others the lower insurance rates and the exclusion of gasoline machines from the docks and piers were distinct influences; and that "after proving successful in these fields the manufacturers became bolder and proved to the large express companies that, for short haul and city transfer work, the light electric wagon was more economical than the horse. The light petrol delivery wagon three or four years ago was far from the efficient vehicle of today, in fact the American ones at that time were little removed from glorified pleasure chassis. English built vans of the class were kept out by the tariff."

Going further, the writer is of the opinion that the construction of electric railroads was an object lesson in the possibilities of electric transportation, but he refers to the condition of the roads as a whole as not such as to justify the use of motor vehicles for "long hauls," and maintains that because of the character of the highways interurban motor transit of over an area of 30 or 40 miles radius is impracticable, owing to the heavy depreciation of the vehicle.

In other words, the writer believes that the limitation of motor traffic to within practically 20 miles from a commercial centre, because of the poor roads, has been a reason for the utilization of the electric vehicles in American cities and towns. This remarkable view of the motor vehicle possibilities is the more remarkable from the fact that it reveals so little knowledge of America, and it is decidedly interesting because it is published in what is regarded as being at least a dependable source of information.

KELLY-SPRINGFIELD BRANCHES.

Maker of Kelly Trucks Establishes Chain of Service Stations Throughout the Country.

The Kelly-Springfield Motor Truck Company, Springfield, O., maker of Kelly trucks, has announced a chain of 14 factory branches and service stations in the principal centres of the country, in order that first class service may be given to the users of its products. The branches are located at the following points: New York City, Chicago, Philadelphia, Cleveland, O.; Dallas, Tex.; Seattle, Wash.; Birmingham, Ala.; New Haven, Conn.; Kansas City, Mo.; San Francisco and Los Angeles, Cal.; Boston and Worcester, Mass.; Providence, R. I.

Each branch is in charge of a manager who is also district manager for the surrounding territory. Several more factory branches will probably be added in a short time. In no case is an agent in the smaller cities more than a few hours distant from a service station and his supply of repair parts, etc., can be augmented in a short time.

The Motor Truck Club of New York City, which is an organization composed largely of men identified with the industry, trade and differing transportation interests, has been established in permanent headquarters in room 1004 in the United States Rubber Company's building, at Broadway and Fifty-eighth street. Previously the office of the club was at 1845 Broadway, where the members met very frequently at lunch, and where the monthly meetings were held. The office is well furnished, has many conveniences, and at it much desirable information is available for the members and visitors.

VULCAN WINNER OF ECONOMY TRIALS.

IN AN economy trial during May 5, 6, 7 and 8, and in competition with 17 machines over a route of 288.7 miles, from Washington, D. C., to Hagerstown, Md., Harrisburg, Penn., Hanover, Penn., and Washington, a Vulcan four-ton truck carried its load at a cost of 1.22 cents a ton-mile, making it the sweepstakes winner. There was no other vehicle entered in the same class. There were seven divisions and a section of non-contestants, making eight in all.

The trials were promoted for the benefit of business men of Washington and vicinity, and the interest of the national government was evidenced by the observation of the machines and the work accomplished with them by a number of departmental officials and attaches.

The route for the first day called for a drive of 68.9 miles, with a noon stop at Frederick, distant 43 miles from the start. The second day the way was to Harrisburg, 70.7 miles, with the noon control at Shippenburg, 32 miles from the start. The third day the route was to Columbia, Penn., 31.5 miles, where the stop was made at noon, and then on to Hanover, 65.3 miles. The last day the run was to Baltimore, 43 miles, and thence to Washington, the total for the day being 83.8 miles.

Each machine was required by the rules to carry its rated capacity of freight, or to be subject to a penalty for the shortage. The entrants in the several classes were: Division No. 1K, 1000 pounds or less capacity—Hupmobile No. 9, 800 pounds; International Harvester, No. 19, 1000 pounds. Division No. 2K, 1001 to 1500 pounds capacity—White No. 17, 1500 pounds; Atterbury No. 13, 1500 pounds; Atterbury No. 20, 1500 pounds. Division No. 3K, 1501 to 2000 pounds capacity—Wilcox No. 5, 2000 pounds; Atterbury No. 14, 2000 pounds; Little Giant No. 3, 2000 pounds. Division No. 4K, 2001 to 3000 pounds capacity—Mais No. 2, 3000 pounds; Witt-Will No. 4, 3000 pounds; McIntyre No. 10, 3000 pounds; Autocar No. 11, 3000 pounds; Atterbury No. 15, 3000 pounds; White No. 18, 3000 pounds. Division No. 5K, 3001 to 4000 pounds capacity—Lauth-Juergens No. 12, 4000 pounds; Atterbury No. 16, 4000 pounds. Division No. 6K, 4001 to 5000 pounds capacity—Rowe No. 8, 5000 pounds. Division No. 8K, 8000 pounds capacity—Vulcan No. 1. Non-contesting division—United States ambulance; Brown No. 100, capacity eight persons; Four-Wheel-Drive No. 101, capacity eight persons; White No. 102, capacity eight persons.

The rules of the competition were very carefully applied and the greater part of the penalties were for adjustment or attention that would be expected under normal conditions of operation, and which were as trifling as adjusting carburetors, replenishing oil and water, cleaning gasoline supply pipes, and the like, and beyond this were broken chains, leaks in radiators, and happenings of minor consequence. The only serious condition to eventuate was the breaking of the front differential of the Four-Wheel-Drive ambulance, and even with this mishap the machine finished, driving through the rear wheels only. The Vulcan truck was heavily penalized when it was forced to shed half its load because of the inability to obtain traction of the Middlebrook hill the first day. Having climbed the hill with the half load, this was taken off and the truck returned for the remainder. At the top of the hill the full load was put on and the run continued. The penalization was for time lost and not for mechanical faults.

In arriving at a score the cost of gasoline was 20 cents a gallon and oil 45 cents a gallon. The penalties for loss of time or work on the road was figured at 1000 points representing $1, a technical inspection for broken parts on the same basis, and a trial of the brakes, clutch and gearset. Taking the aggregate of these and the cost of fuel as stated the scores were computed.

The scores show the following:

No.	Make	Road Penalty	Other Penalty	Total Penalty
2	Mais	0	0	0
5	Wilcox	0	0	0
10	McIntyre	0	0	0
18	White	0	0	0
19	I-H-C	0	0	0
102	White	0	0	0
8	Hupmobile	8	0	8
13	Atterbury	16	15	31
100	Brown	23	2	25
16	Atterbury	32	1	33
11	Autocar	35	1	36
3	Little Giant	12	31	43
17	White	30	15	45
4	Witt-Will	65	1	66
14	Atterbury	69	1	70
15	Atterbury	123	1	124
12	Lauth-Juergens	132	1	133
8	Rowe	125	33	158
20	Atterbury	155	5	160
1	Vulcan	217	20	237
101	Four-Wheel-Drive	297	175	472

The results by divisions, together with the total cost from which the score is obtained by dividing by 288.7 (the mileage) is as follows:

	Division 1K, 1000 Pounds or Under, Speed 12 Miles.			
19	I-H-C	1000 pounds	$5.01	$.0347
9	Hupmobile	800 pounds	5.48	.0474
	Division 2K, 1001 to 1500 Pounds, Speed 12 Miles.			
17	White	1500 pounds	$5.16	$.0238
13	Atterbury	1500 pounds	6.05	.0279
20	Atterbury	1500 pounds	9.04	.0417
	Division 3K, 1501 to 2000 Pounds, Speed 11 Miles.			
5	Wilcox	2000 pounds	$7.52	$.0260
14	Atterbury	2000 pounds	7.81	.0270
3	Little Giant	2000 pounds	8.00	.0277
	Division 4K, 2001 to 3000 Pounds, Speed 10 Miles.			
18	White	3000 pounds	$6.10	$.0140
10	McIntyre	3000 pounds	7.85	.0181
11	Autocar	3000 pounds	7.96	.0183
15	Atterbury	3000 pounds	8.02	.0185
2	Mais	3000 pounds	9.55	.0220
4	Witt-Will	2500 pounds	9.36	.0289
	Division 5K, 3001 to 4000 Pounds, Speed 10 Miles.			
16	Atterbury	4000 pounds	$9.96	$.0172
12	Lauth-Juergens	4000 pounds	12.38	.0214
	Division 6K, 4001 to 5000 Pounds, Speed 10 Miles.			
8	Rowe	5000 pounds	$18.96	$.0262
	Division 8K, 8000 Pounds, Speed Eight Miles.			
1	Vulcan	8000 pounds	$14.95	$.0122
	Non-Contesting Ambulances.			
102	White	Eight persons	$5.98	$.0276
101	Brown	Eight persons	9.59	.0442
102	Four-Wheel-Drive	Eight persons	11.43	.0525

BRIEF NEWS OF MANUFACTURER AND THE TRADE

Manager L. A. Hailey of the Chicago branch of the Motz Tire & Rubber Company, Akron, O., maker of Motz tires, has added Charles R. Serfass and S. F. Frensdorf to his sales staff. Both men are considered among the foremost tire salesmen in the country.

Harry S. Houpt, who recently resigned as sales manager of the American Locomotive Company, New York City, maker of Alco trucks and pleasure cars, has been elected vice president of the Gurney Elevator Company. He will have charge of installations of more than $50,000 and will locate his office in New York City.

Frederick C. Benson, who was formerly associated with C. A. Benjamin in the Packard garage at Syracuse, N. Y., has taken an important position in the sales department of the American Locomotive Company, New York City, maker of Alco cars and trucks, to which place he was appointed by Mr. Benjamin since the latter became general sales manager.

The White Company, Pittsburg, Penn., a factory branch of the White Company, Cleveland, O., maker of White trucks and pleasure cars, has recently completed and occupied its new salesroom and service station at the corner of Craig street and Baum boulevard. The structure is shown in an accompanying illustration and is something of an innovation, in that it is built on the side of a hill and is so designed that vehicles may enter from the street level both in the basement and on the main floor. Each floor has 15,000 square feet of space, the basement being devoted to housing heavy trucks and for storage purposes, the first floor to salesroom and offices and the second to the repair department, machine shop and stock rooms. More than $75,000 worth of repair parts are carried in stock and 50 people are employed.

New Salesroom and Service Station of the White Company in Pittsburg, Penn.

The Knickerbocker Motor Truck Company, New York City, maker of Knickerbocker trucks, has sold $250,000 in preferred stock in order to provide for a factory extension necessitated by constant growth.

The Chase Motor Truck Company, Syracuse, N. Y., maker of Chase trucks, is planning extensive additions to its plant. New buildings are being added for manufacturing purposes and the general offices will be enlarged to double their present size.

M. H. Carter, formerly with the Heppenstahl Knife & Forge Company, has been made eastern representative of the parts department of the Driggs-Seabury Ordnance Corporation, Sharon, Penn., maker of Vulcan trucks.

M. E. Grable, formerly with the Old Reliable Motor Truck Company, Chicago, maker of Old Reliable trucks, has been made manager of the New York branch of the Universal Motor Truck Company, Detroit, maker of Universal trucks, succeeding H. W. Walton.

The Menominee Motor Truck Company, maker of Menominee trucks, formerly the D. F. Poyer Company and previous to that D. F. Poyer & Co., has purchased 12 acres of land adjoining its present plant at Menominee, Mich., and additions to the factory will be built.

William P. Kennedy and Joseph A. Anglada, consulting engineers, are to open headquarters in the United States Rubber building, 1790 Broadway, New York City. Mr. Kennedy, who is a transportation expert, has for several years been prominently identified with the American Locomotive Company, New York City, and the Baker Motor Vehicle Company, Cleveland, O., the latter maker of Baker electric cars, as a consultant, while Mr. Anglada is probably best known for his work in developing demountable rims.

V. Link, chief engineer of the Universal Motor Truck Company, Detroit, maker of Universal trucks, has resigned. He is said to be the original designer of the Universal truck and is reported to contemplate entering business for himself.

W. A. Zimmerman, general manager of the Mercury Manufacturing Company, Chicago, maker of Mercury trucks, has established a branch at Boston, Mass., while George F. Kehew will look after the New England interests of the company. The service station and salesrooms will be located at 239 Massachusetts avenue, Cambridge, Mass.

The Electric Products Company, Cleveland, O., maker of the Wotton automatic battery charging panels, has moved from its congested quarters at 6536 Carnegie avenue, to its new building at 10514 Dupont avenue.

The Weller-Thomas Company, Zanesville, O., was recently incorporated by capitalists of that city and will erect a plant in which to manufacture motor fire apparatus.

The Kissel Motor Car Company, Hartford, Wis., maker of KisselKar trucks and pleasure cars, has opened what is said to be the largest building in the United States devoted to the sale and care of one make of automobiles. The service station provides 70,000 square feet of floor space and in addition to the separate salesrooms for the trucks and pleasure vehicles, contains a garage, machine shop, paint shop and stock room. The structure is three stories high.

The Veerac Motor Truck Company, Anoka, Minn., maker of Veerac commercial vehicles, has opened a branch at 247 West Forty-seventh street, New York City, with H. B. McGinley as manager.

The Murray County Auto Company has been formed at Slayton, Minn., and will erect a modern garage building on Main street, that city. All modern apparatus for repair work, etc., will be installed. The company will handle the KisselKar, Studebaker, Buick, Paige and Mitchell lines of pleasure cars and trucks.

Brooks F. Martin of Shinniston, W. Va., is to open a garage in the Holt building on Walnut street, Grafton, W. Va. He will handle the Oakland and Mitchell pleasure cars and the Bessemer and Gramm motor trucks.

The Kissel Auto Company, Los Angeles, Cal., and the Standard Motor Company of San Francisco, Cal., have been amalgamated under the name of the Pacific KisselKar Branch. An idea of the extent of the operations intended by this new company may be gathered from the fact that the corporation is capitalized at $500,000. This is the largest automobile company ever organized on the Pacific Coast, it is said. The incorporators are: W. H. Hughson and G. N. Emmons of San Francisco, H. K. Butterfield and E. Roger Stearns of Los Angeles and George A. Kissel of Hartford, Wis. The latter is president and Mr. Butterfield is vice president of the parent Kissel Motor Car Company, Hartford, Wis., and the new organization is formed to market KisselKar trucks and pleasure cars in the Pacific Coast territory.

The Ents Automobile & Battery Company, St. Louis, Mo., has opened its new electric garage and storage battery repair station in the downtown section of the city. The company will

make a specialty of caring for electric trucks. Mr. Entz was for over 12 years with the Electric Storage Company as engineer and manager of the Baltimore and St. Louis offices and for the past four years has been the western representative of the Philadelphia Storage Battery Company.

G. W. Felts has taken the interest of Mr. Bacon in the firm of Langford, Bacon & Myers, distributor of Lauth-Juergens trucks, made by the Lauth-Juergens Motor Truck Company, Fremont, O., and has been appointed vice president of the concern. He has established a branch house at Los Angeles, Cal., which he is managing, being assisted by Harry C. Collins, formerly head of the office of the Allis-Chalmers Company.

The Brown Car Corporation, New York City, distributor of Brown trucks, made by the Brown Commercial Car Company, Peru, Ind., has opened offices in the United States Rubber building. The members of the company are Harry W. Torney and W. P. Fargo. They were formerly in business at 52 William street and have a salesroom at 2000 Broadway.

The Brady-Murray Motors Corporation was recently incorporated at Albany, N. Y. Arthur C. Brady is president, Arthur T. Murray is vice president and sales manager, and J. M. Breitenbach is secretary, treasurer and service manager. The corporation will act as eastern distributor of Smith-Milwaukee and Maccarr gasoline trucks, Lansden electric trucks and Chandler pleasure cars. The general offices of the concern are at 30 Church street, New York City.

The Lincoln Motor Car Works, Chicago, maker of Lincoln trucks, has granted to the Lincoln Motor Sales Company, Los Angeles, Cal., the manufacturing rights for the Pacific Coast of the Lincoln half-ton wagon. Not only will this permit of more prompt delivery, but will save many freight charges. It is the intention of the sales company, of which John A. Meeks and B. F. Taylor are secretary and treasurer, and vice president and general manager, respectively, to manufacture 1000 vehicles the first year, establishing branches in all the principal cities on the Pacific Coast.

The Signal Motor Truck Company has been incorporated at New York City, with a capital stock of $350,000. The incorporators are: J. S. Coates, W. C. Floyd-Jones and F. C. Canfield.

The General Auto Trucking Company, New York City, has been incorporated with capital stock of $25,000. The incorporators are: Albert A. Benedise, Thomas G. Cannon and George W. Cannon.

J. Cross, cartage expert, has become associated with the Universal Motor Truck Company, Detroit, maker of Universal trucks.

Joseph Stern, formerly connected with Wyckoff, Church & Partridge, New York City, has taken the American rights for the sale of Commer trucks, and has opened an office in the Thoroughfare building, Fifty-seventh street and Broadway, New York City.

John A. Graham, formerly sales manager for the Westfield Motor Truck Company, Westfield, Mass., has entered the employ of the Sanford Motor Truck Company, Syracuse, N. Y., maker of Sanford trucks, as district manager, with headquarters at Boston. Mr. Graham is a mechanical engineer and was formerly a resident of Boston.

Otto Stoll, formerly manager of the St. Louis branch of the General Motors Truck Company, maker of G. M. C. trucks, has been appointed assistant sales manager, succeeding E. J. Kilborn, who has become general manager for the Chicago district.

Joseph D. Porter, who has been sales manager for the Garford Company, Elyria, O., maker of Garford trucks and pleasure cars, has retired and has been succeeded by George F. Russell, who has been acting as supervisor of Willys-Overland district managers east of the Missisipi river.

J. R. Coleman, formerly connected with the E. R. Thomas Motor Company, the Chalmers Motor Company, the Hudson Motor Company and the Packard Motor Car Company, has resigned his position as chief engineer and designer of the Atterbury Motor Car Company, Buffalo, N. Y., maker of Atterbury trucks. Mr. Coleman is well known to the trade, having started with the Thomas company in 1904, when that company was in its infancy. His most prominent previous connection was with the Hudson Motor Car Company, as assistant chief engineer to C. H. Taylor. The distinct change of design of the Atterbury line of trucks is representative of his class of work.

The Welch Plant at Pontiac, Mich., one of the General Motors group, will in future be known as Northway plant No. 2 and will aid the Detroit factory in the production of Northway motors. Since the Welch car was taken to Detroit for manufacture the Welch plant at Pontiac has made motors for the G. M. C. trucks. The change will make no difference in the number of employees.

The Royal Equipment Company, Bridgeport, Conn., maker of Raybestos brake lining, Duplex brakes and brake bands, and Gyrex, the mixer, has moved into its new building on Railroad avenue, which was recently completed.

Henry E. Riker & Co., distributor in Ohio and Indiana for Stewart delivery wagons, made by the Stewart Motor Corporation, Buffalo, N. Y., has purchased the Windermere garage building at 1356 Euclid avenue, Cleveland, O., together with a 35-year lease on the land. It will be known as the Windermere-Euclid garage and will be the headquarters of the firm.

W. B. Miller, vice president and director of the B. F. Goodrich Company, Akron, O., maker of Goodrich tires, has been replaced by D. M. Goodrich, Mr. Miller having withdrawn from the company.

The International Harvester Company, St. Louis, Mo., has leased the garage building at 3944-3946 Olive street, as a sales and display room for automobiles and trucks. The building is in one of the automobile centres of St. Louis and was designed for such tenancy.

The White Company, Boston, Mass., has under construction one of the largest and best equipped motor car and motor truck establishments in New England. It will be located on Commonwealth avenue and will contain every modern appliance known to the automobile industry.

The Janesville Motor Company, Janesville, Wis., has in process of construction a new garage and service building, which will embody every feature in modern garage service. Many special features of repair work will be cultivated. The company handles the Jeffery and Service motor trucks, and the National, Overland, Rambler, Cutting, Borland electric, Stutz, Chevrolet, Little, Herreshoff and Stanley steam pleasure cars.

The Twin City Motor Car Company, St. Paul, Minn., northwestern distributor for Saurer, Mack and Modern trucks, and the complete lines of Maxwell cars, recently moved into its new quarters, 163 West Sixth street, where one of the finest garages in that city is located. Gustav Michaud is in charge of the pleasure car sales and A. F. Williams handles the truck department.

L. F. Marshall, who was formerly with the United States Tire Company, is now with the solid tire department of the Swinehart Tire & Rubber Company, Akron, O., maker of Swinehart tires.

G. A. and F. J. Meyer, Detroit, have leased for three years the old marine engine plant on East Jefferson avenue, at the foot of Baldwin street. The building will be used for the manufacture of Oliver trucks, made by the Oliver Motor Truck Company.

The Motor Wagon Company, Detroit, has announced a new truck, which will be of 1000 pounds capacity and use a four-cylinder, four-cycle motor and three-speed selective transmission. In the past the company has manufactured only an 800-pound wagon with a two-cycle engine.

The National Can Company, Detroit, has entered the radiator field and will build radiators for motor vehicles under patents granted to Theodore Coffelder. Frank W. Doyle, formerly with the McCord Manufacturing Company, will have charge of the production. C. V. Jones, who has been connected with the Long Manufacturing Company of Detroit and Chicago, will have charge of the sales department.

The Michaelson Motor Company, Minneapolis, Minn., has been organized to manufacture pleasure cars and a three-wheel parcel car. The latter will use a two-cylinder, 10 horsepower motor, a multiple disc clutch and a two-speed transmission.

The Eclipse Wheel Company, Camden, N. J., has been formed with capital stock of $300,000 to make wheels for motor trucks and other motor vehicles. Those interested include F. R. Hansell, J. A. MacPeak and G. H. R. Martin.

B. F. Parker, formerly of Denver, Col., is promoting a motor truck concern at Salt Lake City, Utah, which is expected to erect a large factory and employ 3000 skilled workmen.

The Highland Body Manufacturing Company, Elmwood Place, O., has been formed with capital of $81,900 to make bodies for automobile trucks and pleasure cars. W. Morrison, J. M. Morrison, R. E. Simmons, Jr., G. P. Stimson and J. Wilby are the incorporators.

George McLaughlin of Erie, Penn., has organized a company which will be incorporated at $100,000 to manufacture motor trucks ranging from one to four tons. Those interested are: Charles T. Stewart, A. H. McQuitty, J. B. McLaughlin and George McLaughlin.

The J. A. Mais Commercial Car Company, Indianapolis, Ind., is being organized to manufacture a new 1500-pound truck, designed by J. A. Mais, a younger brother of A. F. Mais, formerly of the Mais Motor Truck Company, and now with the Studebaker Corporation, Detroit, maker of Studebaker commercial vehicles and pleasure cars.

Abendroth & Root Manufacturing Company, 50 Church street, New York City, has opened a sales office and service station at 278-280 Halsey street, Newark, N. J. A. G. Bogardus is manager of the truck department of the company and will make his headquarters at the Newark plant.

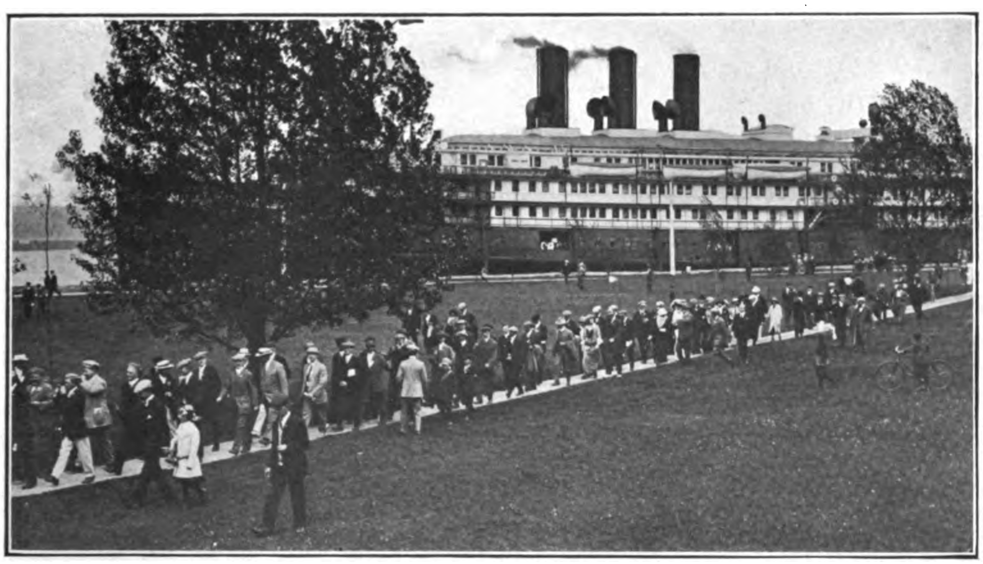
The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., JUNE, 1913 No. 6

BRITISH ENGINEERS INVADE AMERICA.

International Meeting of Institution of Automobile Engineers and Society of Automobile Engineers at Detroit Preceded and Followed by Tour of Industries--Hearty Welcome and Lavish Entertainment Mark Visitors' Trail.

FRATERNIZING with the members of the Society of Automobile Engineers, visiting some of the leading shops and factories of motor vehicle builders and makers of metals and components, being entertained with hospitality that threatened to ruin digestion because of its variance from custom, and rushing about the country in trains, steamers and motor cars in a manner that impressed them that American activity is a delirium, the English guests of the automobile industry of America have passed the most strenuous three weeks of pleasure that they have ever experienced. The English people live and do things differently than Americans, and this fact has been realized by the visitors, who have been shunted about the eastern section of the nation according to a schedule that was made up with the purpose of crowding into a given period sight-seeing and pleasure that was believed commensurate with the character of the event.

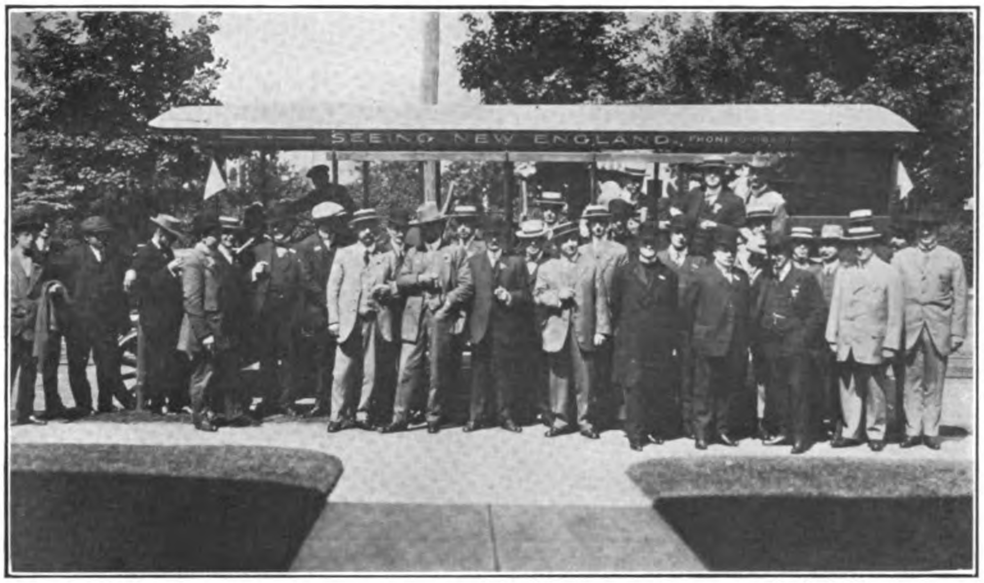


The Participants in the Lake Outing Disembarking from the Steamer City of Detroit III and Marching to the Plaza at Sault Ste. Marie.

The Americans entertained in relays, but there was only one group of Britishers, and whenever another city was reached an enthusiastic committee and a coterie of interested manufacturers saw to it that the programme was carried out with such additions as might be regarded as desirable. The English engineers maintained that never had they been so splendidly received and so courteously entertained, and for everything they had seen they had the highest praise, but one of them commented as the itinerary was nearing an end that he would sleep all the way as the steamship was returning.

While being driven to the factory of the American Locomotive Company at Providence the sightseeing 'bus was driven through Blackstone boulevard, a handsome residential part of the city, a series of shouts from the visitors aroused apprehension in the entertainers until the comment was heard, "I say, now, the first taste of England we've seen, y'know!" and there was the liveliest admiration, for it was maintained that "it was just like a country lane in England." The reply to this was that the simile might be expected, for the guests were in New England, a fact not generally realized.

Regarded by the industry as a whole the visit of the English engineers means a decidedly closer relation and a better understanding of America and American industrialism. The invasion of England by the Americans in 1911 created a fellowship that has been promoted by the visit of the Englishmen, and strong ties of friendship have been established that will no doubt have decided influence in both nations. The knowledge that each body of engineers has of the other, of the policies, practises and manufacturing methods, will be distinctly beneficial, and exchange of experience will no doubt be extremely



The New England Visitors on Their Arrival at the Plant of the Potter & Johnston Machine Company, Pawtucket, R. I.

The visitors sailed from Tilbury, England, May 17, on the steamship Minnewaska, leaving London the morning of that day, and the party that joined the ship consisted of the following: Institution of Automobile Engineers, T. B. Browne, president, London; T. C. Pullinger, Paisley, and Charles Wheeler, London, members of the council; Basil H. Joy, secretary, London; F. S. Bennett, London; Carl F. Benson, Coventry; C. A. Banston, Cambridge; H. Massac Buist, London; Thomas Clarkson, Chelmsford; E. G. Davison, New York; J. B. Ferguson, Belfast; F. E. Filer, London; J. Inglis Ker, Glasgow; J. A. Prestwich, Tottenham; R. W. Smith, Redditch; Mr. Smith, Jr., Redditch; E. B. Wood, Bristol; Lucien Bollack, Coventry; E. Wooler, Bristol. Society of Motor Manufacturers and Traders, J. B. Dunlop, Dubiin; C. Gilbert Moore, Twickenham; Tom Norton, Llandrindod Wells; E. C. Paskell, Birmingham. The ladies of the party included Mrs. T. B. Browne, Mrs. Thomas Clarkson, Mrs. T. C. Pullinger and Mrs. E. B. Wood.

The voyage was uneventful and the steamer reached New York the afternoon of May 26, but so late that the intended introduction to the great American pastime at the polo grounds was given over, and after reaching the Hotel McAlpin there was but little time remaining before the guests were novitiates at a "beefsteak dinner," where the evening was passed in social intercourse. Mr. Dunlop, who is notable from his invention of the pneumatic tire and the luxuriant beard he wears, was rather the hero of the cabaret entertainment. The committee of arrangements consisted of A. R. Cumner, chairman; A. L. McMurtry, R. McA. Lloyd, Howard Marmon and Secretary Coker

profitable. One of the facts impressed upon the visitors was the volume of manufacturing and the manner in which it is conducted. One of the party in commenting on his observations said that there has always been a disposition to discount the statements relative to the magnitude of the automobile industry in America and the number of vehicles in use, but he had reached a conclusion that the facts had been conservatively stated instead of being overdrawn, and the possibilities of motor vehicle transportation were almost unlimited.

The magnitude of the works visited, the character of the equipment, the qualities of the products, the systems and methods of manufacturing, the rapidity of production, the facilities for receiving and shipping, the attention given to employees' welfare, were features of the industrial plants visited, and it was the observation of the engineers that American manufacturing was on a mammoth scale. In the outward journey to Detroit the steel and tube mills of Pittsburg and McKeesport were seen, and those who journeyed into New England saw machine works that are justly considered as without equals anywhere in the world.

The English Engineers and Their Entertainers at the Factory of the American Locomotive Company at Providence, R. I.

F. Clarkson of the S. A. E., and the members were assisted in New York by the committee from the Metropolitan Section, which is composed of William P. Kennedy, chairman; Herbert Chase, secretary; L. P. Brown, P. P. Dean, Alexander Dow, N. P. Pope, H. M. Swetland, C. W. Fletcher, A. J. Slade, Joseph Tracy, H. C. Wilson, P. D. Wagoner, Roger B. Whitman and J. N. Anglada.

The following morning the party were taken in motor cars about New York, visiting Battery park, Wall street, the Brooklyn bridge, Prospect park, Brooklyn; Williamsburg bridge, the tower of the Woolworth building, and then the Automobile Club of America, where, after inspection of the laboratory, luncheon was served. The afternoon was devoted to drives about the city and a demonstration of the motor fire apparatus of the city was made by the courtesy of Commissioner Johnson for the benefit of the visitors.

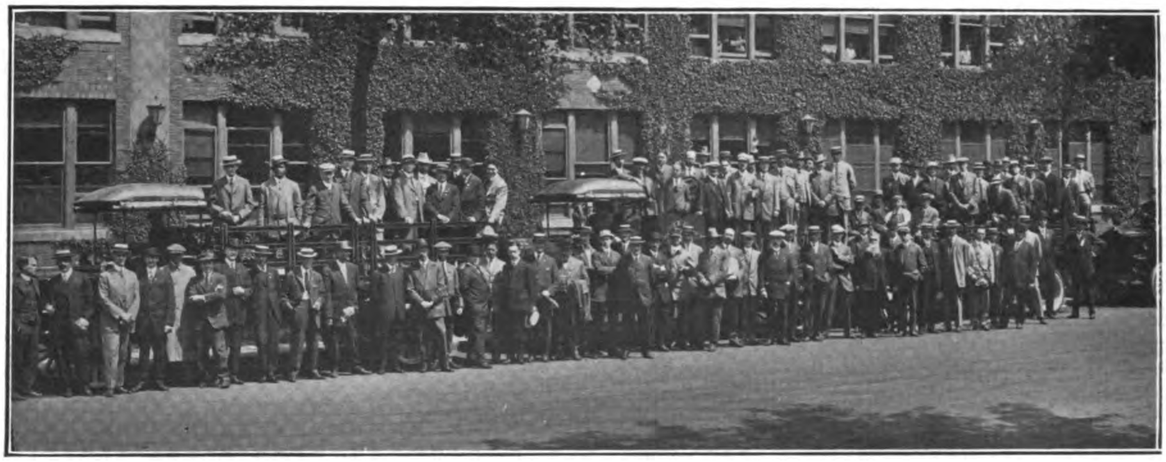
In the evening the regular May session of the Metropolitan Section of the S. A. E. was held in the ball room of the Hotel McAlpin, and the subject of the papers generally was "Motor Starting Devices," these being descriptive of different devices. The papers were read by the following: Prof. W. C. Marshall, Crescent air system; R. H. Coombs, Prest-O-Lite acetylene system; Alexander Churchward, Gray & Davis electric system; E. V. Hartford, Hartford electric system; B. Solawitch, Northeast electric system: W. E. Raignel, Disco acetylene system; H. L. Towle, Rushmore system; M. Wilson, Westinghouse electric system; Leonard Kebler, Ward Leonard electric system; Prof. Benjamin P. Bailey, Bailey electric system: M. Stow, Entz electric system; Charles A. Mudge, U. S. L. electric system; H. C. Gardner, Warner spring system. The reading of the papers was heard in part by members of the Electric Vehicle Association of America, who adjourned their regular monthly meeting early for the purpose of meeting the visitors. Because of the length of time required discussion of the papers was deferred until the midsummer session on the steamer after leaving Detroit.

The morning of May 28 the party, accompanied by Secretary Clarkson of the general committee of arrangements and several other members of the committee, left New York for Pittsburg in a special train that was chartered to take them through to Indianapolis. The party included about 20 members of the S. A. E. Reaching Pittsburg in the evening the train was side-tracked and the following morning the visitors were received by the Pittsburg reception committee, consisting of George L. Norris, chairman; Earl Blough, C. L. W. Rys, George W. Sargent, T. W. Schoepf and F. S. Slocum at the Pittsburg Athletic Association's club house, where breakfast was served. The ladies were entertained in several Pittsburg homes, and the men were first taken to the Homestead mills of the Carnegie Steel Company, special trolley cars taking them about the city.

The operations in the world's greatest steel works were observed with decided interest, and the engineers paid careful attention to the equipment and facilities of the mills. Later in the day a steamer took the party to McKeesport, luncheon being served on the boat, where the mills of the National Tube Company were inspected. On the return dinner was served at the Fort Pitt hotel, and after a reception the party returned to the special train, accompanied by a considerable number of Pittsburg engineers and members of the S. A. E., and the journey to Indianapolis was resumed.

Some of the Merrymakers in Fantastic Costumes Chosen for Invasion of Historic Island of Mackinac, Preliminary to the Sport.

The train reached Indianapolis the morning of May 30 and after breakfast the party was taken in charge by the Indianapolis committee, consisting of William G. Wall, chairman; George T. Briggs, Charles S. Crawford, Carl G. Fisher, W. O. Kenington, Howard Marmon, Harry C. Stutz and G. A. Weidley. The visitors were driven to the speedway, where a special stand was reserved for them. Here the international race was witnessed with intense interest, the visitors commenting that the track, had it the banking of the Brooklands circuit, would probably be equally as fast, while it has the advantage of permitting the specta-



Society of Automobile Engineers and the Institution of Automobile Engineers During the Visit to the Factory of the Packard Motor Car Company, Detroit, Mich.

tors to see considerably more of the racing.

The morning of May 31 the Indianapolis committee and the visitors were driven to the Wheeler & Schebler factory, where the production of carburetors was observed, and then the party was taken to the Prest-O-Lite factory at Speedway, where the operations incident to making and charging tanks with acetylene gas, and the use of acetylene gas engine starters were decidedly interesting. This concluded the business of the day and the next stop was made at the house of the Indianapolis Canoe Club, where luncheon was served. President Howard Marmon of the S. A. E. presided and there were speeches by H. O. Smith, president of the Premier Motor Manufacturing Company, President T. B. Browne of the Institution of Automobile Engineers, and C. A. Bookwalter, former mayor of Indianapolis. The party then was driven to Broad Ripple, where a clambake was served, and the remainder of the day was passed until the time for leaving for Detroit.

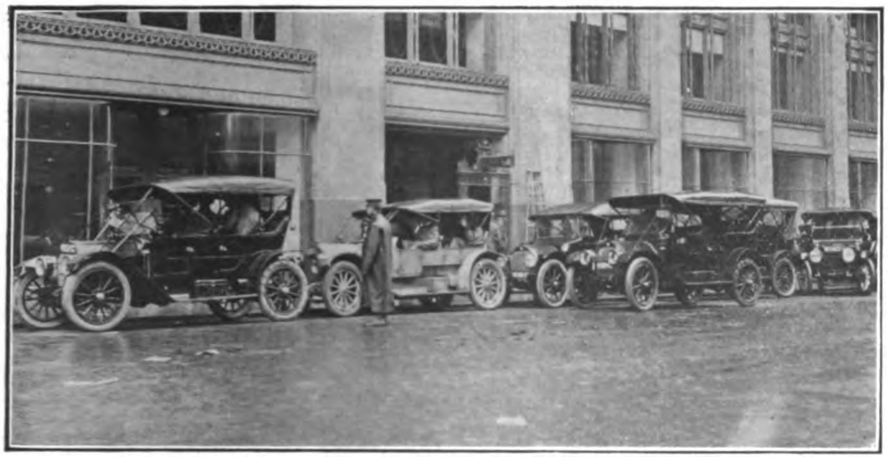
Arriving at Detroit the party was met by the local committee, consisting of Charles M. Hall, chairman; Howard E. Coffin, H. W. Alden and E. T. Birdsall, and after the visitors had been shown to their quarters at the Hotel Pontchartrain and had been comfortably established the day was passed in motor drives about the city and its suburbs. This was practically the first day that the Britons were not held to a schedule.

Monday, June 2, the first event was a visit to the Ford factory, the party numbering more than 100, and the English visitors were personally shown about by Henry Ford. If there was one thing more than another that amazed the invaders it was the speed of assembling the Ford cars, and they had abundant illustration of the results from organization, and one of these was the inspection of chassis at the rate of one every 20 seconds. The daily production of cars was then from 925 to 950 cars, but 1117 have been turned out in a single day. President T. B. Browne of the Institution of Automobile Engineers was shown a pile of engine cylinder blocks and asked to select one. He did so and marked it. Two hours later he was shown to a car in front of the factory and asked to take a little ride. On his return he was asked how the car run, and he said its performance was excellent. The hood was then lifted and he was shown the block of the engine he had marked after he had entered the factory.

A pleasant incident was the presentation of a Ford car to Secretary Basil H. Joy of the Institution of Automobile Engineers by George W. Houk, who represents the Rudge-Whitworth Company, maker of wire wheels, in this country. Mr. Houk lived in England for 14 years and knew Mr. Joy intimately the greater part of that time, and the gift was the result of an impulse, Mr. Houk buying the car and prevailing upon Henry Souther, former president of the S. A. E., to bestow it upon Mr. Joy. Before leaving Detroit Mr. Joy shipped the machine to Montreal and will take it to England from that port.

After lunch the visitors and their hosts were driven to the Cadillac factory, where they were welcomed by President H. M. Leland and divided into groups and shown through the plant by guides. The processes

The American and British Automobile Engineers and Their Guests During Their Stay at the Plant of the Ford Motor Company, Detroit, Mich.



The English Guests of the Society of Automobile Engineers Leaving the Hotel McAlpin for a Sightseeing Drive Around New York.

were observed with keen interest. Tea was served and the visitors were each presented a gold Cadillac fob before the party left the factory. A theatre party concluded the formalities of the day.

Tuesday, June 3, a tour was made of the Packard factory, where 15 pleasure cars and six freight wagons are produced daily, the annual production being 1200 cars and 1800 wagons. Here the methods in each department were given close attention, and the extreme care and precision taken to insure perfect work was noted with decided interest. When the tour had been completed the company was entertained at lunch by President H. B. Joy and the officers of the company. The afternoon was given over to a visit to the axle factory of the Timken-Detroit Axle Company. The production is now nine sets of axles for wagons and 130 sets of axles for pleasure cars each day.

The banquet in the evening at the Hotel Pontchartrain was the crowning event of the day. President Howard Marmon of the S. A. E. welcomed the company and the guests and expressed the thanks of both bodies for the freedom of the city, which had been formally extended in the form of engraved parchment communications to both societies. Howard E. Coffin was toastmaster and speeches were made by President T. B. Browne of the Institution of Automobile Engineers, by T. C. Pullinger of the same organization, and by H. M. Leland, president of the Cadillac Motor Car Company.

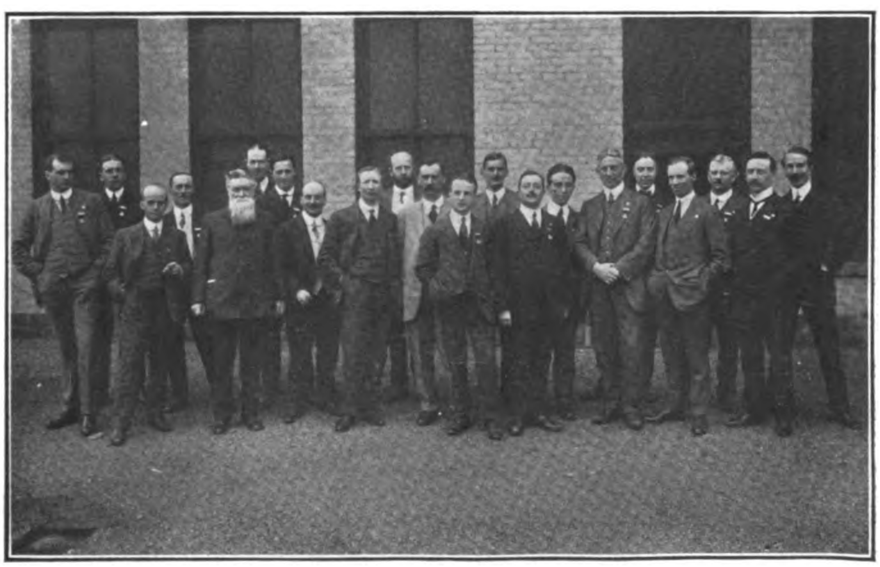
Wednesday, June 4, the morning was devoted to visits to the factories of the Hudson Motor Car Company and the Continental Motor Manufacturing Company, and lunch was partaken of at the plant of the Chalmers Motor Car Company. The party had at this time reached its greatest proportions. The members of both societies then returned to the hotel and left to embark on the steamer that left at 3 in the afternoon. The capacity of the City of Detroit III was taxed by the party, which numbered about 600, there being a goodly number of ladies. The afternoon remaining was passed in viewing the beauties of the Detroit river, Lake St. Clair and the St. Clair river, and the evening was given over to social intercourse.

Thursday, June 5, the summer meeting of the S. A. E. was begun at 10 in the morning. Following the address by President Howard Marmon came the report of the treasurer, the election of applicants for membership and new business.

At this meeting President T. B. Browne of the Institution of Automobile Engineers made formal expression of the appreciation of his party for the reception and entertainment, and presented to President Marmon an honorary membership in the body of which he is presiding officer. This is the first and only honor of the kind bestowed by the institution. Secretary Coker F. Clarkson was presented a silver card tray and Alden L. McMurtry, in charge of the transportation of the S. A. E., was given a handsome bit of silver plate.

The reports of the officers showed that the society had 1635 members, this evidencing a gain of 72 members, 91 associates and seven juniors since Jan. 1. The treasury contains a balance of $6,557.84. Henry Souther, chairman, made report for the iron and steel division and David Ferguson, chairman, made report for the ball and roller bearing division. Then came a series of papers as follows: "Manufacture and Physical Properties of Malleable Iron," by Enrique Toucedal; "A New Tensile Test Piece and Holder," by K. W. Zimmerschied; "Pneumatic Tires," by Paul W. Litchfield, and "Lubricating Oil," by Harry Tipper. These papers were discussed at length and then the "Design and Treatment of Leaf Springs" and "Worm Gears" were topics for consideration.

In the afternoon at 2 the session was resumed, this being for commercial vehicle subjects. The pa-



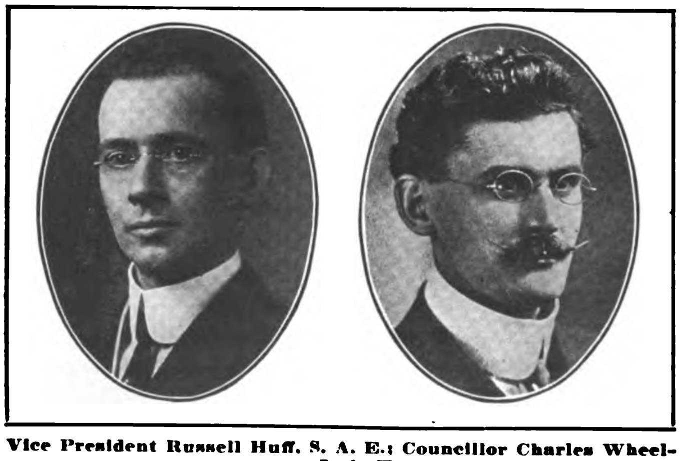
The Visiting Members of the Institution of Automobile Engineers at the Automobile Club of America, New York City.

The Two Presidents: Howard Marmon, S. A. E.; T. B. Browne, I. A. E.

pers included the following: "Petrol 'Buses," by T. B. Browne; "Steam 'Buses," by Thomas Clarkson; "Calculating Depreciation of Commercial Automobiles," by Charles Wheeler, and "The Measurement of Horsepower," by E. B. Wood, all of whom are members of the Institution of Automobile Engineers; "Jackshaft versus Double Rear-Wheel Brakes," by Arthur Laycock, and "Metal Wheels," by Arthur J. Slade. These subjects were of particular interest to engineers engaged in freight vehicle designing and construction, and the papers by the English experts came in for close attention. At the conclusion of these, reports were made by William P. Kennedy, chairman of the truck standards division, and chairman of the commercial car wheels division. The topic for discussion was "Comparative Efficiency of Solid Motor Tires."

The steamer stopped for two hours at Sault Ste. Marie, and then continued on to the destination at Mackinac Island. A feature of the evening was a formal meeting of the "Bonnie Boys of Britain," in which the Englishmen made report as inspectors of the American automobile industry, and the raid by the Indiana Indians led by Big Chief F. E. Moscovics, in which five captives were lashed to a stake and after a council were sentenced.

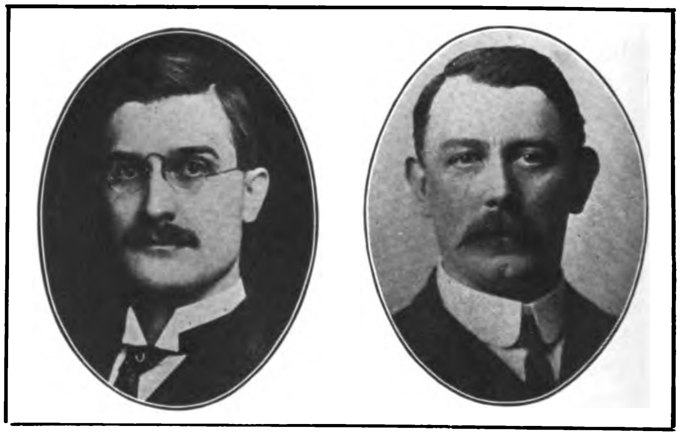
Friday morning the session was taken up by papers on "Automobile Production Inspection Methods," by E. F. Roberts; "Influence of the Sales Department on the Design of Motor Cars," by F. E. Moskovics; "Wire Wheels," by George W. Houk; "Motor Construction," by Claude E. Cox; discussion, these reports—electrical equipment division, by Andrew L. Riker, chairman; broaches division, by C. W. Spicer, chairman; pleasure car wheels division, by Henry Souther; nomenclature division, by Elliott J. Stoddard, chairman; miscellaneous division, by Arthur Holmes, chairman, and the consideration of these topics: "Electric Motor Starters," "Possibilities and Limitations of Utilization of Electricity in Operative Motor Car Functions," "Possibility of Weight Reduction in Motor Car Design" and "Hobbing Methods."



Vice President Russell Huff, S. A. E.; Councillor Charles Wheeler, I. A. E.

The steamer reached Mackinac Island at 2:30, where the engineers and their guests disembarked. A large number of the men appeared in improvised costume and the stop was given over to informal pleasure, and in the evening after the steamer was Detroitward bound the S. A. E. returned the entertainment of the Britons the evening before with a so-called play entitled "Reverse English on the Heat Treatment," which assumed the spirits of the English engineers in purgatory in the year 2000. This was a decidedly interesting diversion.

The morning of Saturday, June 7, marked the closing of the meeting, at which a paper was read entitled "Notes on Power Variations with Atmospheric Changes," by Herbert Chase, another on "A Consideration of Certain Problems of Carburetion," by Arthur B. Browne; a report was made by Chairman John O. Heinze for the motor testing division, and "Gasoline Motor Fuels" and "Motor Manifolds" were discussed. At this meeting the committee appointed at the first session to express the opinion of the society relative to the Oldfield patent bill, now pending in Congress, reported the following, which was unanimously adopted:



Vice President John G. Perrin, S. A. E.; Councillor T. C. Pullinger, I. A. E.

"Resolved: First, that the Society of Automobile Engineers is opposed to the Oldfield bill; second, that it is opposed to any fundamental changes in the patent law without thorough investigation and fair public hearings; and third, that a copy of this resolution be forwarded, on behalf of the society, to every senator and representative and to other engineering societies."

On arrival at Detroit the formalities incident to the meeting ended, and the English visitors lost three of their number, who left to make tours of the western

The Two Secretaries: Coker F. Clarkson, S. A. E.; Basil H. Joy, I. A. E.

states, and the remainder of the party and a group of the American organization left by boat for Cleveland, where they arrived Sunday morning. The headquarters was at the Hotel Statler. Sunday was devoted to sightseeing, and Monday visits were made to the White, Winton, Peerless, Baker and Rauch & Lang motor car factories, and to the plants of different manufacturing establishments that produce engines and components. A few elected to go to Akron and inspect some of the tire making plants. The party left that night by boat for Buffalo. The Cleveland committee consisted of G. R. Wadsworth, chairman; Harold B. Anderson, C. H. Foster, Christian Girl, L. H. Kittredge, John B. Hull, George E. Merryweather, Fred R. White, C. L. F. Wieber, Alexander Winton and C. B. Wilson.

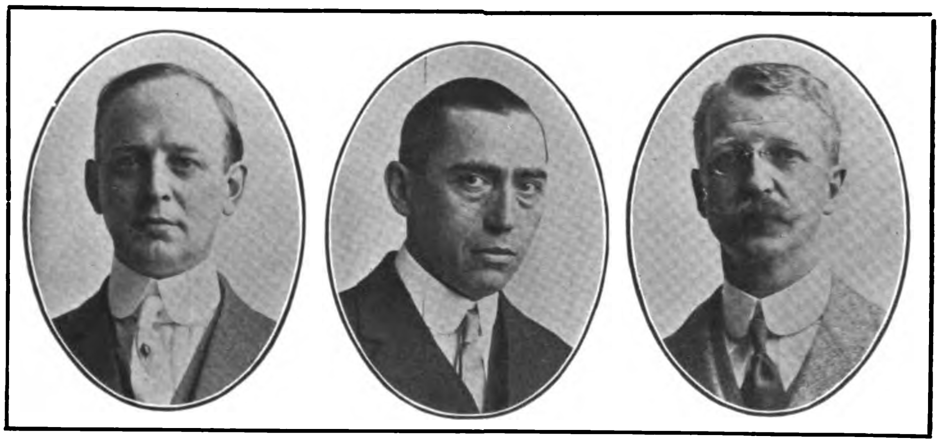
At Buffalo the party, then numbering about 50, was received by a committee made up of David Fergusson, chairman; W. H. Barr, L. H. Gardner, W. H. Ladd, Henry May, C. L. Sheppy and H. K. Thomas. After breakfast on the steamer the factory of the Pierce-Arrow Motor Car Company was visited, and in the afternoon the visitors were taken to Niagara Falls, the Pierce-Arrow Motor Car Company being the host at luncheon at the factory and at supper at Niagara Falls. At this point the English party divided, President and Mrs. Browne leaving for the West to continue a journey around the world, a number going to New York to sail on the Mauretania for England, June 11, and Secretary Coker F. Clarkson and A. L. McMurtry of the general committee took charge of a group consisting of F. S. Bennett, Carl T. F. Benson, Lucien Bollack, C. A. Cranston, J. B. Ferguson, E. C. Paskell, R. W. Smith, E. Wooler, Charles Wheeler, Mr. and Mrs. E. B. Wood and Secretary Basil H. Joy that had elected to make the visit to New England.

Pawtucket, R. I., was reached the morning of June 11 and the tourists were received by a committee consisting of F. P. Nehrbas, chairman; W. E. Biddle, C. B. Buxton, R. A. Downes, Earl Roberts, R. A. Vail and P. C. DeWolfe. Mrs. Wood was welcomed by a committee consisting of Mrs. F. P. Nehrbas and Mrs. W. A. Viall, who arranged a day of sight-seeing and a trip to Newport. The engineers were escorted to the To Kalon Club for breakfast, where they were the guests of James C. Potter, and then were taken to the works of the Potter & Johnston Machine Company, where they saw the operation of a very large equipment of automatic machinery and were provided with a series of blue prints showing the work and stating the material and the time required for the processes.

The party was conveyed to the plant of the American Locomotive Company at Providence, where the works were inspected, and after luncheon as the guests of the American Locomotive Company the mammoth shops of the Brown & Sharpe Manufacturing Company, one of the best known concerns of the world, which has more than 22 acres of floor space and employs between 8000 and 9000 men, was visited. The group, which numbered about 40 persons, was then taken to the Rhode Island Country Club for dinner, and the return to Providence was made to meet a special car that was a part of the 1:25 morning train for Bridgeport. Secretary Joy alighted with the party at Pawtucket, but returned to the train and continued on to New London, where he started for Montreal.

Thursday, June 12, the party visited the plant of the Locomobile Company of America at Bridgeport, where Andrew L. Riker was the local committee, and later on passed through the factory of the Spring Perch Company. After lunch, at which the Locomobile Company of America was host, the visitors were driven by motor car to New Haven, and there visited the shops of the New Haven Carriage Company.

The Hotel Taft was headquarters for the night. Friday, June 13, the party went to Hartford in the morning and there was met by Harold L. Pope, the local member of the committee. The shops of the Pratt & Whitney Company, the Pope Manufacturing Company and the Hartford Rubber Works Company were visited. The Pope Manufacturing Company was the host at luncheon. In the afternoon at 4 the visitors left by boat and enjoyed a sail down the Connecticut river and through Long Island sound, reaching the city of New York the following morning.



Members of American Committee of Arrangements: Left to Right, A. B. Cumner, Chairman; Allen L. McMurtry and Robert McA. Lloyd.

POWER WAGON DESIGN AND SERVICE.

The paper by Charles Wheeler, councillor of the Institution of Automobile Engineers, was on "Calculating Depreciation of Commercial Automobiles," as follows:

Depreciation has been defined as the diminution which takes place in the value of a wasting asset in spite of the amount expended on it in repairs, and there is no doubt that in assessing the diminution in value of commercial vehicles something more than the application of definite accountancy principles is necessary. This is probably true as applied to all factory accounting, which in effect is dissection as opposed to combination, the usual operation of commercial accounting.

If exception be taken to this short paper on the ground that the subject treated is more of a commercial than of an engineering character, I would point out that the scientific keeping of accounts connected with automobile production and the running of automobiles is of vast importance, and necessitates expert engineering advice in nearly all departments. In fact, the engineering head must not only know what cost he is "up against" on the score of depreciation, but he must have a big voice in the determination of the governing factors.

The first factor to be considered is the estimated "working life" of the automobile, and this depends very largely on the particular circumstances in which the vehicle is used. Thus a Maudslay motor 'bus runs some 700 miles a week, while a Maudslay stores van averages say 140 miles per week. Obviously, other things being equal, the length of the "working life" must be considerably in favor of the stores van. The "working life" also depends upon the quality of the vehicle, i. e., quality in design and manufacture, and is thus closely connected with the initial cost. The "working life" further depends upon the condition in which the vehicle is maintained, and this in turn depends upon the driving and supervision, and the amount spent on renewals.

Having decided upon an estimated "working life" L, the next step is to consider by what method the initial cost should be spread over the period decided upon—in other words how the depreciation should be written off year by year. Three methods at least warrant consideration, namely:

1. To divide the capital outlay C, by the number of years at which the "working life" L, is estimated and charge the quotient against each year's working costs.
2. In the first year to write off a high percentage of the cost; in the second and succeeding years to write off the same percentage on the diminished value, that is, the balance left after deducting the previous year's depreciation.
3. To divide the capital outlay C, less residual value, R, (that is the estimated value of the vehicle at the end of its "working life") by the number of years, etc.

In each method, renewals and repairs, as they occur, are charged against "general running expenses." The first method cannot of course be recommended where any degree of accuracy is required. The second method is perhaps financially the soundest if it be desired to ascertain from one's books the actual realizable value of the vehicle at any moment. Although this method gives a fairly true result in the end, it has the objection that in its earlier years the cost of the service is overloaded.

The third method, expressed by the formula $\frac{C-R}{L}$, where C = capital outlay, R = residual value, and L = the estimated years of life, is that recommended as being the most practical and accurate method. The only observation necessary on this method is one dealing with the reconsideration of L at a later period. When the life of a vehicle is reconsidered, the unexpired capital outlay should be taken as the basis for the revised charge for depreciation. Thus suppose $\frac{C-R}{L} = \frac{500-50}{5}$, the annual depreciation being £90; by the end of two years the capital outlay would have been written down to £320. If the estimate of life be then revised and extended to seven years in all, with five more to run, then $\frac{C-R}{L} = \frac{320-50}{5} = £54$ annual depreciation.

Obsolescence is a factor which has to be considered, as it is by no means improbable that some combination of circumstances may render it desirable to dispose of a particular vehicle before it is really worn out. From a strict accounting point of view obsolescence may not be depreciation, but the factor is at least of sufficient importance to "round up" any percentage that may be determined by other considerations, and if, in the future, by perfecting the machines their ordinary working life can be reckoned as longer than it is at present, obsolescence will become of more importance, for a machine which is still quite efficient mechanically may be rendered uneconomical by the introduction of improved types. When such time arrives it may be prudent to make provision under this head, which while not strictly proper to depreciation may very conveniently be connoted.

There remains one other detail for consideration, namely, the treatment of small additions to plant. The effective life of the additions may or may not be coterminous with that of the vehicle, and any attempt to bring their depreciation within the scheme for the depreciation of the vehicle itself would cause complications which it would not be worth while to incur. The practise recommended is to regard such small additions as chargeable to maintenance, which, in effect, means writing them off at 100 per cent. in their year of purchase.

MOTOR TRUCK WHEELS.

The paper contributed by Arthur J. Slade on "Motor Truck Wheels," set forth that the author had suggested to the commercial car wheels division of the standards committee that in the standardization of metal wheels, along lines similar to the standardization of wood wheels, certain practises, as to material design, should be recommended for the benefit of the motor truck designer, and that while the suggestion was not approved it was met by the proposal that a paper be presented to the meeting with a view to bringing out available information as to suitable materials and designs for truck wheels, through those members best qualified to express themselves on the subject with authority.

After considering the development of wooden wheels and early metal wheels and the service to be obtained from them, the paper was as follows:

It will be noted that comparatively few well known truck builders in this country are at present using metal wheels and those who are using them have not previously used wooden wheels. There is one notable exception, however, the Pierce-Arrow Motor Car Company, on some of whose trucks I have recently seen cast steel wheels, although since the introduction of the Pierce five-ton truck on the market wooden wheels have been standard. It is hoped the engineers of that company will give us the benefit of their experience and their reasons for making this change.

The vast majority of motor truck manufacturers, including those whose product dates back to the beginning of the motor truck industry in this country, have used wooden wheels consistently, improving their design from time to time, but not abandoning a material for wheel construction which has on the whole proved entirely satisfactory.

Through the courtesy of Mr. George R. Wadsworth, member of this society, I have been furnished with reports on the mileage and condition of the wood wheels on a large group of gas trucks of three, four and five-tons capacity, which show that in some cases the mileage covered approaches closely to 70,000. On the assumption that the tire mileage secured on these trucks is 10,000 miles a tire, this would mean that some of the wheels have been subjected to six tire changes. The report states, regarding these wheels, that "they were all in first class condition and not a moment's inconvenience or delay has been caused by them and there is not the slightest indication of trouble in the near future." These wheels, it is scarcely necessary to say, are of modern design, are accurately constructed of suitable material, and are carefully inspected for conformation to the accepted S. A. E. motor truck wheels standards. The contention that wood wheels get out of round and present difficulties in tire application does not seem to be substantiated in this case.

As pointed out in papers on wood wheels, presented by Mr. Bert Morley and Mr. C. B. Hayes at the January, 1912, meeting of this society, there is no question as to the adequacy of the supply of wood for wheel manufacture. The experience of many of our members with wood wheels on motor trucks, extending over periods of years, indicates that the truck manufacturers in this country are not being forced by necessity to adopt metal wheels, so that if the truck manufacturer who has been using wood wheels satisfactorily for many years is to be influenced to adopt a metal wheel, it is essential that he should be shown that some practical advantage would be gained by the change.

When this society visited our British fellow engineers, several members of the American party made inquiries regarding the service rendered by metal wheels, in both England and France, and the results of the investigation were set forth in a short report which I made to the society at the January, 1912, meeting. Briefly, it was found that cast steel wheels were being used in England in a variety of forms. Also that structural steel wheels were preferred by some. Further, that the consideration of wood wheels had not been abandoned, even by those using steel wheels as a standard, and that some truck manufacturers preferred wood to metal, and used the former as standard. In France the wood wheel appeared to be the standard to the practical exclusion of metal wheels.

More recently Mr. L. C. Freeman, a member of this society, submitted a paper on "Tendency of Foreign Motor Truck Design" at the January, 1913, meeting in which he made the fol-

lowing statement: "While cast steel wheels seem to give very good results under certain conditions, they do not appear to be a universal panacea for all wheel troubles One user who has operated a great many trucks of many different makes said that cast steel wheels were all right until the tires wore thin. In this statement I think there is food for a great deal of thought. A built-up wheel of structural steel was giving him excellent service and almost no trouble." Doubtless some of our British fellow engineers present at this meeting can supply us with up-to-date information on the status of the metal and wood wheel in Great Britain.

At the present time there is undoubtedly a general effort being made by manufacturers of parts for motor trucks to add metal wheels to their product: and with the exception of one manufacturer, who proposes to build wheels of malleable iron, all of them are building their wheels of cast steel.

What, then, are the specific advantages offered by metal wheels which should influence a motor truck designer to specify metal construction rather than wood? The advantage must be such that it can be proved to the purchaser of the truck that he will secure an actual financial gain by the change which the engineer proposes, because to the purchaser the prime questions are the expense of operating and maintaining the truck over a period of years and the earnings or savings which the vehicle will effect. Theoretical considerations, unless borne out and proved in practise, are unavailing. Practical service conditions count with the hard-headed business man—not laboratory or experimental tests and calculations.

First, it is claimed by one of our members, who is chief engineer of a company about to place cast steel wheels on the market, that: "It is now conclusively proven that there is a distinct saving in tires on steel wheels. Some of the largest tire manufacturers guarantee as much as 30 to 40 per cent. longer life on steel than wood." Inquiry made of the leading tire manufacturing companies, verbally or by letter, has failed to verify that statement. The opinion of several tire company officials seems to be personally in favor of metal wheels for the one reason that they are likely to be made more accurately to size, but the tire companies positively decline to guarantee an added mile or to even express the opinion that added mileage can be expected.

As to the question of accuracy of workmanship, it is entirely feasible for the wood wheel manufacturers, under the present S. A. E. standards, equipping the wheels with S. A. E. bands, to work within the necessary tolerances and provide wheels which will have the accuracy required. Accuracy in workmanship is a question of care in construction and careful inspection and the manufacturer who insists upon accurate wood wheels conforming to S. A. E. standards has no trouble in securing them.

Another claim made for metal wheels is that their strength is greater than wood wheels. Assuming the cast steel wheels to be free from defects, and to have the chemical and physical characteristics recommended by the iron and steel division, these wheels certainly develop marvelous resistance to shocks. I witnessed a test of such a wheel recently which was subjected to the impact of a weight swung as a pendulum against the side of the felloe and the wheel was deformed beyond the semblance of a wheel and even then did not show any fracture. At the same time, as has been pointed out by the iron and steel division, steel castings cannot be inspected against blow holes, and had the wheel in question contained some concealed defect, failure in testing would probably have resulted. The difficulty in securing uniform steel castings free from defects and conforming to the S. A. E. standards is generally conceded and several of the foundries making cast steel wheels in this country, at the present time, are having difficulty in making steel castings of other motor truck parts which will pass the inspection of some of their customers. As to the strength of well constructed and properly designed wood wheels, the front wheel of a truck manufactured by one of my clients came in contact recently with a road obstruction with such impact that the strain broke the steering gear, but the wheel was uninjured, and on another truck a rear wheel was subjected to such an impact that the axle spindle was bent without injury to the wheel. Therefore, on the question of strength, that of the high grade wood wheel is entirely adequate for commercial purposes.

The contention is also made that the metal wheel will dissipate heat more effectively than the wood wheel. There has come under my observation no case in which a truck tire on a modern motor truck has been injured by lack of heat radiation under service conditions. I assume that the heat developed in a solid rubber tire is due to the deformation of the rubber and this is greatest near the surface of the rubber which comes in contact with the ground. This surface is in contact with the air and I should expect that the heat would be radiated through the air more easily than transmitted through the base of the tire to the wheel and hence radiated by the wheel, felloe and spokes.

The fourth point in considering the relative merits of wood and metal wheels is the comparative cost and weight. From information received from one of my clients regarding wood wheels being regularly manufactured and used on this company's trucks, and from information received from the chief engineer of one of the companies which is bringing out cast steel wheels, the following comparison of weight and cost has been made:

Set of wheels for three-ton truck to take 36-inch by five-inch tires, front; and 40-inch by four-inch dual tires, rear; wood wheels equipped with S. A. E. band and Timken hubs and flanges—steel wheels having band and hubs integral—

Wood	Steel	Increase of Steel over Wood
	Weight.	
Front 122 lb. each	151 lb.	12.4%
Rear 212 lb. each	373 lb.	76.0%
Set 668 lb.	1048 lb.	57.0%—380 lb.
	Cost.	
Front each $20.00	$26.80	34.0%
Rear each $30.00	52.10	74.0%
Set each $100.00	157.80	57.8%—$57.80

Information obtained from a European manufacturer of cast steel wheels indicates that their weight is substantially the same as American cast steel wheels, but the price is 25 to 50 per cent. higher, thereby placing the steel wheel at a still further disadvantage as far as cost is concerned. Consequently, it would appear that the cast steel wheels are both costlier and heavier than the wood wheels. The burden of proof seems to rest with the metal wheel manufacturer, that they have an economic advantage over the wood wheels, resulting in a financial saving to the owner of the truck equipped with metal wheels.

There is one type of metal wheel which might overcome the disadvantage, real or fancied, of the wood wheel, and which would at the same time eliminate the element of risk always existent in a casting, and also the criticism of the built-up structural steel wheel, the loosening rivets. This is the drop forged wheel. Drop forgings of high-grade steel, which after suitable heat treatments, develop extraordinary physical characteristics, would, in my opinion, be an ideal construction, unless their first cost proved prohibitive. I hope we may hear something from the drop forging experts among our membership in regard to the feasibility of such a construction for motor truck wheels.

As stated at the outset of this paper, its purpose is to stimulate discussion and secure additional data, by which the motor truck designer may be benefited and assisted in his work. I trust it may accomplish its purpose.

JACKSHAFT VS. REAR WHEEL BRAKES.

"Jackshaft vs. Double Rear Wheel Brakes" was the title of a paper by Arthur M. Laycock, which was in part:

An investigation from a designer's outlook on the following lines may prove instructive: 1, danger of braking through any intermediary and not direct; 2, the detrimental effects of brakes on end of jackshaft; 3, effect on universal joints and differential gears.

Our government in its specifications for army trucks has without any question taken the right step in insisting on both brakes being on the rear wheels. This must have a beneficial effect on the trade in general. Similar enactments should be made in all our large cities to save property and life in congested streets. The London Scotland Yard authorities, who are represented by a capable and efficient board of engineers, now insist that all motor 'buses and public service vehicles have both brakes fitted to the rear wheels.

Whatever may be the status as to brake location on the pleasure car, there is no comparison between the energy stored up in a six-ton machine and the heaviest of pleasure cars. In case of collision at a given speed the disastrous possibilities of brake failure are more pronounced in commercial than in pleasure car work.

Many designers have the opinion that you can take a pleasure car axle and use it as a jackshaft. This is all right if jackshaft brakes are not used, the conditions then being analogous to pleasure car work so far as the jackshaft ends are concerned; in other words, you can never impose strains greater than the full torque of the motor. But with the jackshaft brake you may exceed this from two to three times; the larger the truck the more pronounced, of course, is the difference. Figures based on a six-ton truck are so glaring in this respect that the outer ends must be so large as to be out of all proportion to the rest of the truck.

Take, for example, a six-ton truck, 50 per cent. overload, 80 per cent. on the rear, which would be equal to about 10,000 pounds on each wheel; 40-inch rear wheel diameter, sprocket diameters six inches and 22 inches, countershaft brake drum diameter 12 inches and coefficient of friction between the road and the tires 75 per cent.

Considering the jackshaft brake first.

$$\text{The pull on chain} = \frac{10{,}000 \times .75 \times 20}{11} = 13{,}650 \text{ lbs.}$$

The horizontal component of 13,650 lbs. = 13,300 lbs.

$$\text{Reaction on fulcrum pin A} = \frac{13{,}300 \text{ lbs.} \times 3}{6} = 6650 \text{ lbs.}$$

Plotting the above forces the resultant reaction on the sprocket bearing is 19,950 lbs.

The distance from the centre line of the sprocket to the centre line of the sprocket bearing being 3.5 inches, and the distance from the centre line of the sprocket bearing to the centre line of the countershaft 20 inches, the total load on bearing is equal to

$$\frac{19{,}950 \times 3.5}{20} + 19{,}950 = 23{,}445 \text{ lbs.}$$

Considering a motor of 50 horsepower, 1000 revolutions a

minute, with 12:1 reduction, that is, 4:1 in the bevels and 3:1 in the transmission, we obtain

$$\text{Pull in chain required in driving} = \frac{50 \times 63{,}000}{83 \times 2 \times 3} = 6300 \text{ lbs.}$$

You will notice that in the double rear wheel brake construction it is utterly impossible to impose any load whatever on the jackshaft ends except, of course, the reaction from the radius rods, which can be taken easily direct on the frame. The figures given undoubtedly account for the many failures as well as for the exceptionally large brackets used by some. Almost 12 tons is quite an item to take care of. It seems perfectly absurd to introduce these strains on the end of the jackshaft and more than double the work on the chain. Where pleasure car axles, with brakes attached, have been used for jackshafts there has been more or less trouble. The bearings, tubes and drive shafts are subjected to stresses they were never designed for.

In the above paragraphs I have endeavored to demonstrate conditions the jackshaft brake imposes on the surrounding parts. This has not been considered by any means from every angle, but sufficient, I think, to show the superiority of the double-brakes-on-the-rear over the jackshaft brake design. It is manifest that the wheels are the only place for the brakes, spelling finality in design as to their location, unless dependability and cost be sacrificed in the extreme.

In making a diagnosis of the situation pertaining to propeller shaft brakes, the same questions may be asked and like answers returned as in the case of jackshaft brakes. The question may be raised as to the propeller shaft brake eliminating to some extent the tendency of skidding. * * * It is obvious that the durability of joints and gears must be sacrificed with the propeller shaft brake, and I am sure that a good

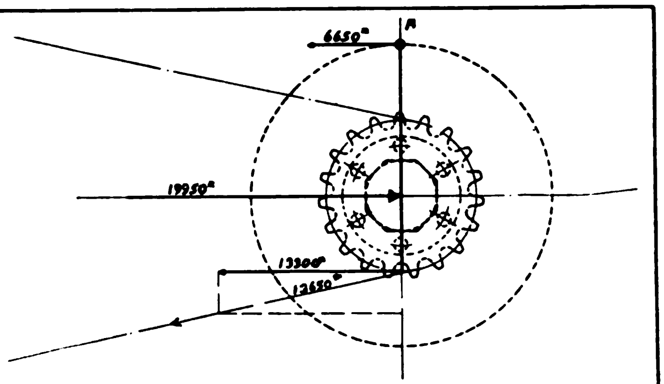


Fig. 1

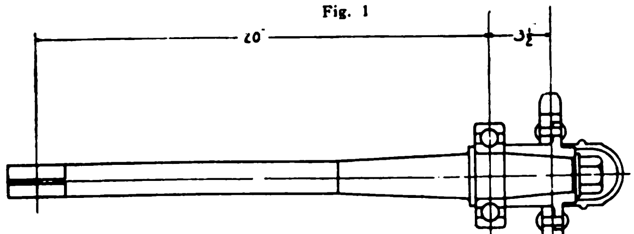


Fig. 2

equalizer on the brake rock shaft with double brakes on the rear wheels leaves nothing to be desired so far as side skidding is concerned, some of our largest makers having always retained this construction.

The replacement of joints, however, is not so expensive or troublesome as the repair of broken differential gears. Precisely the same theory holds good here; most of our differential gears are working under exceedingly high pressures. In fact, it is quite common practise to work at from 75,000 to 100,000 pounds, the stresses being the resultant of the full torque of the engine and the reduction in transmission. The steel used here will probably range from 100,000 to 150,000 pounds a square inch elastic limit. Very few makers have a greater factor of safety than 2:1. These parts are also subjected to the same 200 per cent. overload from the rear, which you will admit must be a pretty warm place for gears already stressed to 100,000 pounds a square inch from engine torque alone. Considering that these extreme loads are of a reversible nature, it is very surprising the gears stand up at all, speaking well for the grade of steel used and the particularly fine heat treatment obtained in our large factories.

The drive shafts are usually stressed very high, even in the full floating type. In the semi-floating construction the combined bending torsion is very rarely taken care of adequately, figuring from the road wheel end, whereas it may be quite safe as to taking the torque of the motor only. Take for example a five-ton worm driven truck of approximate weight with body of 8000 pounds; figuring 25 per cent. overload and 80 per cent. on the rear, which in round figures comes out 8000 pounds a wheel; using an engine of 4.875 inches by six inches, four cylinders, which will develop 47 horsepower at 1000 revolutions per minute; reduction in first gear 3.77:1, and a ratio of 8:1 in the axle; the diameter of the propeller shaft 1.5 inches; diameter of pitch circle on worm three inches and diameter of rear wheels 40 inches.

The torsion moment in propeller shaft from the engine on low gear would equal

$$Mt = \frac{47 \times 63{,}000}{265} = 11{,}300 \text{ inch-pounds.}$$

The torsion moment in propeller shaft from road wheels equals

$$Mt = \frac{16{,}000 \times 20 \times .75}{8} = 30{,}000 \text{ inch-pounds.}$$

$$\text{Stress in propeller shaft from engine} = \frac{11{,}300 \times 5}{1\tfrac{1}{2}^3} = 16{,}700 \text{ lbs. per sq. in.}$$

$$\text{Stress in propeller shaft from road wheels and propeller shaft brake locked} = \frac{30{,}000 \times 5}{1\tfrac{1}{2}^3} = 44{,}000 \text{ lbs. per sq. in.}$$

$$\text{Tangential pressure on teeth} = \frac{11{,}300}{1.5} = 7420 \text{ lbs. on low gear.}$$

$$\text{Tangential pressure on teeth} = \frac{30{,}000}{1.5} = 20{,}000 \text{ lbs. from locked wheels.}$$

Of course the question might be brought up that under this load of 20,000 pounds there is no motion, the wheels being locked, but in mountainous country I think you will agree with me, it is quite customary for a man to slide his wheels intermittently, and I am sure we can have considerable speed between the surfaces in contact and pressure very close to this. Many follow this construction in England at the present time, and it would be interesting to have our English friends' views on the subject. Where this design is used it undoubtedly speaks volumes for the dependability of worm gears as applied to heavy vehicles, considering they may be subjected to pressures from three to four times more than in the case of the double-brakes-on-the-rear-wheels construction. The high stress in the propeller shaft is quite easy to take care of, but it is mighty hard on joints, differential gears and bearings.

The above discussion may be radical, but will seem quite in order to anyone who has handled an overloaded car in mountainous country, where an amateur will declutch and roll backwards for a considerable distance and then apply the brakes violently. An observer watching the manipulation of a robust jackshaft or propeller shaft brake, coupled with a fierce clutch on a 25 per cent. grade, and the weight thrown on the rear wheel—as much as 80 per cent.—is led to surmise that the only logical design to stand abnormal shocks is the one involving the minimum number of parts subjected to the strains. To see a six-ton machine under these conditions is an event not easily forgotten by any designer; words are inadequate to express the frightful abuse machines have to stand under the conditions enumerated.

STEAM OMNIBUSES.

The paper by Thomas Clarkson of the Institution of Automobile Engineers on "Steam Omnibuses" was as follows:

In order to avoid misconception with respect to my attitude toward the internal combustion motor using spirit fuel, permit me at the outset to state that I fully appreciate the enormous utility of this type of motor in certain departments of automobilism—that my strictures upon it as applied to 'bus work should not be regarded as the outcome of a prejudiced judgment, but rather as an impartial scientific analysis of the special conditions applicable to 'bus work and heavier automobilism. This to the end that other fuels besides spirit should be utilized, such as kerosene, crude oil, coal, or coke, thereby easing the demands upon the spirit motor and its fuel supply, and leaving it greater freedom of development along its special lines of utility.

Increased facilities for passenger transport in cities are constantly in demand. Transport by electric rail motors, both on the surface and under ground has, to some extent, met this demand. But the automobile public service car, or as it is generally called, the motor 'bus, has already demonstrated its superiority over the rail car or tram.

The main points in favor of the 'bus over the rail car are its flexibility and independence of action. Flexibility is the dominant feature, flexibility of route, both as to deviations, extensions and modifications according to traffic conditions, and also flexibility of control in traffic, especially rapid flexibility of speed so as to accelerate promptly in response to traffic conditions whether congested or otherwise.

Complete flexibility is obviously impossible so long as the motors are dependent upon an extraneous power station. The vehicles must be self-contained and the power generated from within. Flexibility I regard as the keystone to the successful solution of the street traffic problem in cities, and I submit that the type of motor which gives most flexibility with the least trouble and expense is the type which will make good. Hence my preference for the steam motor 'bus in its present perfected form.

A properly constructed steam motor possesses a reserve of energy which is immediately available for a spurt, and acceleration can be speeded up smoothly and without jerk or inconvenience to the passengers. The control by the driver of a steam motor is simplified and the demands upon his energy and nerve force are reduced to a minimum. This last has an

important bearing upon the prevention of accidents and loss of life. The speed is entirely controlled by a foot throttle and no change gears are used.

The weight of a fully laden standard London 'bus is 13,440 pounds. The unladen weight is 7840 pounds. This is about 2000 pounds less than the former weights of both internal combustion and steam 'buses of the same carrying capacity (34 passengers) which were common a few years ago. This substantial reduction in weight has vastly improved the breed of the 'bus, for which thanks are due to the police authorities for insisting upon a lighter construction in order to obviate damage to adjacent properties consequent upon severe road vibrations. It was prophesied that this police demand would rule out the steam 'bus as it did the storage battery electric 'bus. But it is significant that the first 'bus to be licensed under the new regime as to weight was a steam 'bus; as a matter of fact a No. 5 National. This was nearly fours years ago.

I claim that the steam 'bus is still the best, the most efficient and popular, and this view is shared by some of the leading traffic men who control internal combustion motor 'buses. It is noteworthy that every one of the companies running internal combustion 'buses in London have been unable to stand the competition of their largest petrol omnibus rival, and have all been absorbed. Today the only omnibus company able to maintain its independence of the great omnibus combine in London is the company running steam omnibuses.

The advent of the motor omnibus appears to sound the death knell of the street rail car. The public shows a decided preference for the motor 'bus and the reason is not far to seek. The 'bus, owing to its greater freedom and flexibility of action, is easily able to beat the rail car in carrying passengers to their destination in the shortest possible time. Another advantage of the 'bus is that it can pick up and set down at the edge of a sidewalk instead of requiring passengers to walk in the roadway to or from the car. As a rival to the street rail car the motor omnibus has become a very serious proposition, and the perfected motor omnibus should be of immense value in solving the street traffic problem of cities. The presence of rails in the surface of a common road all automobilists will agree is detrimental to the efficiency of the road surface, and to the vehicles using the road.

The following summarized description will explain the leading points of the National steam 'bus: The fuel is kerosene, which is vaporized, mixed with air and burned beneath a water tube generator. The generator is entirely of steel and works at a pressure of 300 pounds (test pressure 1000 pounds). The generator is enclosed in a vertical cylindrical case under the bonnet of the chassis. The generator has a central drum which is closed at the lower end, and fitted at the upper end with a lid for cleaning. The drum is furnished outside with generating tubes of horseshoe form which permits free expansion without strain.

The steam is manufactured in four successive stages: (a) A preliminary heating of the water to about 140 degrees. (b) A secondary heating of the water under pressure to about 400 degrees. (c) Conversion of the heated water into steam at 300 pounds pressure. (d) Superheating of the steam to about 800 degrees.

The steam is utilized in a simple engine, two-cylinder double acting reversible, which drives the rear wheels of the chassis direct through worm gearing at a ratio of about 7:1. There is no clutch and no change gears.

The exhaust steam is condensed, filtered and returned to the tank for further use. The fuel consumption is regulated automatically by steam pressure. The success of the National steam 'buses is doubtless due in great measure to the excellent "fool proof" generator.

Time does not permit me to refer to the springing, steering, axle construction or brakes of the chassis, which are upon standard lines, but there is one detail of the construction of the National 'bus which calls for special notice, i. e., the wheel.

The life of a motor 'bus is extremely strenuous, probably the most strenuous of any automobile. Its annual mileage is about 30,000. Most of this is done on roads teeming with other traffic; consequently a 'bus has to stand hard knocks and rough usage. Wooden artillery wheels have proved unequal to the duty. Wheels constructed of cast steel have proved troublesome and uncertain. The National 'bus road wheel is constructed entirely of forged steel. The spokes are solid drawn tubes welded to a hub which is machined out of a solid forging. The outer ends of the spokes are welded to flanges which are afterwards machined before the rim is shrunk on. The perfect balance of this wheel and the reduction of about 170 pounds in the weight of the four wheels of a 'bus have materially reduced the wear on tires, and the absence of any internal stresses in the wheel is a great factor in reliability and public safety.

The proper lighting of a 'bus has been a troublesome problem, neither oil nor acetylene having proved satisfactory. Electric illumination gives best results. The problem has been to devise suitable electric equipment. This problem has been solved on the steam 'bus in a very simple and satisfactory manner. About 10 years ago I experimented with electric light for 'bus illumination. The first equipment was worked from a storage battery, but it did not pan out and electric lighting was discarded. Subsequently a scheme was devised whereby a small storage battery was used in combination with a special dynamo driven by the car and with cut-outs similar to lighting systems now used on some pleasure cars. After running this combination in service for several years I abandoned it in favor of a dynamo of the ordinary type directly attached to a small steam motor and without batteries or cut-outs. This steam motor runs at a constant speed of 900 revolutions per minute, and the equipment provides current for 150 candlepower a 'bus. The arrangement has proved completely satisfactory. The cost and weight of the installation have been reduced as well as the cost of maintenance; at the same time greater brilliancy of illumination has been secured. Excellence of illumination has proved a bull point in popularizing the steam 'bus and in helping traffic receipts.

Some steam 'buses of the earlier type have been in regular service for the past 10 years and are still running. But the steam 'bus of today has been evolved during the past two or three years since the designer and manufacturer took up the business of running 'buses and maintaining them.

In the short time available for this paper, it is impossible to give a history of the evolution of the modern steam 'bus upon which I have been engaged for nearly 20 years, and as the main object of this paper is to promote a discussion on the relative merits of steam and internal combustion 'buses, I will briefly summarize a comparison between these two types of motor.

The first cost of the 'bus appears to be about equal for the same quality of material and workmanship and with a similar rate of production.

Cost of maintenance—It has so far been impossible to obtain figures which are strictly comparable as to the relative maintenance costs of the two systems. The only way to obtain them would be for the same auditors to examine and analyze the books of both a steam 'bus and an internal combustion 'bus company, and to treat both in precisely the same manner as to depreciation, annual overhaul, establishment expenses, etc. Experience shows that the steam 'bus is in the garage for maintenance a much shorter time than its rival. It is the practise to withdraw an internal combustion 'bus from service one whole day in 10 for maintenance, apart from the withdrawal from service for annual overhaul which usually takes about two weeks. On an average during the year the internal combustion 'bus loses more than 15 per cent. of its total possible mileage. Total possible mileage means every 'bus that is licensed doing every journey every day for seven days a week throughout the year. During the year ended Oct. 31, 1912, the National steam 'buses, lost only 2.847 per cent. of the total possible mileage, and of this only .877 per cent. was due to mechanical failure. That it has been possible to run steam 'buses under the extremely strenuous conditions prevailing in London so as to give over 97 per cent. of their total possible mileage, whereas the internal combustion 'bus is not able to do 85 per cent., speaks eloquently both for the superior reliability of the steam 'bus and its cheaper maintenance.

Tires—There is less wear on tires with the steam 'bus owing to the smooth drive.

Rapid and smooth acceleration—In this respect the steam 'bus is easily demonstrated a winner. The extra steam pressure which accumulates at each stop gives an extra "push off" at restarting.

Flexibility and speed—In this respect also the superiority of the steam 'bus is demonstrated daily.

Illumination—The steam 'bus is admittedly the most perfectly illuminated.

Popularity—The public shows decided preference for the steam 'bus.

Vibration and jerk—There is less vibration on the steam 'bus. The engine does not run when the 'bus is stationary for picking up or setting down passengers, and there is no uncomfortable jerk at starting.

Depreciation—Steam 'buses which I started in regular public service over nine years ago are still running. I cannot find any internal combustion 'buses which have been in service so long. My rule for estimating depreciation is to give a six years' life, and at each annual overhaul to bring the 'bus right up to date.

Fuel—A steam 'bus uses kerosene fuel and so helps to relieve the pressure on the spirit market. With equality of ratio between

$$\frac{\text{price of kerosene}}{\text{price of spirit}} \quad \text{and} \quad \frac{\text{mileage on kerosene}}{\text{mileage on spirit}}$$

there is nothing to choose between either type in cost of fuel. The great increase in the demand for spirit and the absence of a like increase in the demand for kerosene favors the kerosene fired steam 'bus.

Drivers prefer the steam 'bus on account of less fatigue in operation and greater certainty of completing the journeys. Drivers are paid by the journey.

I will conclude the summary by giving the actual figures for lost mileage from all causes during the year ended Oct. 31, 1912, for the fleet of National steam 'buses in London.

'Buses withdrawn from service for annual overhaul	1.844%
'Buses withdrawn from service for passing drivers	.045%
'Buses withdrawn from service for police stops	.023%
'Buses withdrawn from service as a result of accidents	.058%
'Buses withdrawn from service in consequence of mechanical failure	.877%
Total, from all causes	2.847%

I think it will be agreed that these figures are remarkable, especially in view of the fact that the loss of service due to mechanical failure was well under one per cent., having regard to the exceptionally severe conditions of the service. During the above period over 15,000,000 passengers were carried on the steam 'buses.

It must be obvious that a steam motor which gives such results, under the abnormally severe conditions of public omnibus service, should have useful work to do in other departments of commercial automobilism, say for net loads of three tons and over. And it is important to note that for this work the steam motor can use coal or even coke fuel. In this manner a large section of commercial automobilism can be placed right out-

side the range of the oil trusts which now dominate the fuel supply, and commercial transport of first class reliability can thus be supplied at a lower working cost than is possible under present conditions with the internal combustion motor.

LUBRICATING OIL.

The paper read by Harry Tipper on "Lubricating Oil" was in part as follows:

Lubrication, of course, has for its one general object the conservation of power, or to put it another way, the reduction of frictional waste. The amount of lubricating oil used in the running of any machinery is so small that it has probably been neglected in favor of operations which involve much larger sums in the aggregate. A little study of the losses due to friction which occur in the moving equipment of any plant is sufficient, however, to show the enormous possibilities for the conservation of power and the reduction of waste, which lie in the examination of the conditions affecting lubrication and the quality necessary to meet it.

In practical use the oil must vary according to the speed, pressure and heat conditions in the equipment, the amount of moisture, the mechanical arrangements for oiling, together with the question of settlement and filtration. Innumerable modifications may be necessary in the grade of oil required; for instance, the question of dry and wet steam in the cylinders of a steam engine, superheated steam, character of circulating systems, the fit and finish of bearings, etc., all exercise a modifying influence upon the oils which can be used. The accuracy with which the mechanical conditions are determined and the extent to which the manufacturer and his engineering corps are experienced, in the consequent requirements of oils to meet such conditions, are the bases for the successful solution of lubricating problems.

On account of the lack of study which has been apparent on this question, and also partly on account of the rapid extension in the number of fields from which oil is produced, and the better possibilities for comparison in that regard today, it is possible to consider some of the usual methods of determining the lubricating qualities of oils and show wherein they fail of giving any indications of the practical value of such oils under the conditions in which they are to be used.

The common method of specifying lubricating oil which has been in use for a great many years is to stipulate a certain gravity, flash, fire, viscosity and cold test, under the assumption, of course, that such limitations of the tests mentioned will have the effect of obliging the manufacturer to submit an oil which will do the work to the best advantage. A thorough examination of these tests, however, shows that they are not by any means conclusive of the value of an oil for lubricating purposes. In regard to some of them the results are entirely misleading. The reason, of course, is easily determined. Some 20 years ago when practically all the oil which was in general use for lubricating purposes was drawn from Pennsylvania and adjacent fields, and was composed of practically the same hydrocarbon compounds with the same arrangements and was refined under much the same conditions, it was possible to compare two lubricating oils produced under these conditions by the arbitrary tests mentioned above, which were used by the refiner for his own convenience in measuring the uniformity and character of his runs. But the situation is entirely different. The fields from which the oil was drawn principally in those days supply only a very small percentage of the oil which is used today. The newer fields do not always deliver crude oil of the same characteristics either in a chemical or a physical way, and as a consequence these arbitrary tests no longer answer the purpose, as the different chemical and physical construction of the oils is sufficient to make any comparison on the same basis impossible. To put it briefly, such specifications are out-of-date. In the last 20 years new discoveries have been just as frequent in the oil business as in any other industry. New requirements have been imposed upon the oil refiner, owing to changing conditions in the equipment to be lubricated. It is consequently absurd to expect specifications which were permissible 20 years ago, under entirely different conditions, to be of any value to the buyer of lubricating oil today under new requirements and new possibilities.

Taking these tests in detail, let us examine the question of gravity in respect of the present day conditions. Gravity is simply the weight of the liquid in terms of weight of water. * * * The gravity reading is practically of no value to anybody but the refiner, who can and must use it in comparing the uniformity of his runs from the same crude. It has been proved through the gasolines, naphthas and burning oils that it has no relation to their value for use, and in the last two or three years the same feature has been thoroughly investigated and proved in respect of lubricating oils.

The flash and fire tests are represented respectively by the temperature at which oil, being heated at a standard rate, with a standard flame, passed over it at a standard distance, will show a flash or flame from the gases arising from its surface, and the point at which the oil under the same conditions begins to burn. From the standpoint of lubrication, the only bearing which the flash and fire tests have upon the oil under service, is to insure against the presence of volatile constituents which might begin to vaporize at the temperatures reached in ordinary work.

The viscosity of an oil has a considerable bearing upon its value for lubricating purposes, as it determines the speed of flow of the oil under certain temperature conditions, and it is obvious that the rate of flow of the oil is of great importance in considering conditions of pressure and speed in connection with all ordinary lubricating work. The trouble with the viscosity specification as it is used at present arises from the fact that the viscosity depends upon the temperature at which the oil will work, and if this temperature varies considerably from the standard temperatures at which the tests are usually made, there will necessarily be a great deal of difference in the usual working of the oil under the practical conditions involved.

The cold test is of importance as demonstrating the ability of lubricating oil to remain fluid under conditions of exposure to low temperatures. Its value, however, depends entirely upon the work to which the oil is to be put.

The point, however, which should be noted in connection with all these tests on specifications for oils is that they do not demonstrate the value of the oil under practical conditions, and merely put a limit upon the competition which can be secured or upon the amount of oil which can be drawn from for use without in any way furthering the value or advantage. To put this matter concretely, engine oils manufactured from different crudes show the following variations in the characteristics:

Gravity	19° to 31°
Flash	320° to 400°
Fire	370° to 450°
Cold	0° to 30°
Viscosity (on Saybolt instrument)	120° to 750°

or higher at 100° Fahrenheit.

Within this range of characteristics oil suitable for all classes of engines can be picked out, and the question of their suitability would not depend upon the particular test displayed by the oil. Two oils answering the same laboratory tests might show entirely different results in actual work, due to difference in the methods of manufacture not appreciable in a laboratory inspection; one would lubricate and the other would not.

Inasmuch as the arbitrary tests to determine the physical characteristics of the oil do not illuminate its value for any particular purpose, let consider what the oil should do. In order to bring this directly to the point of greatest interest to the society, that is, the lubrication of the motor of automobiles, let me suggest the requirements which a lubricant for this purpose should meet:

1. The oil should possess a sufficient body to keep the bearing surfaces apart at the temperature at which the bearings run.
2. It should possess such qualities as will reduce the friction to a minimum.
3. The flash point should be sufficiently high to insure against the presence of volatile constituents.
4. It should remain fluid at such low temperatures as will be met in service conditions.
5. It should have no tendency to decompose or to form such deposits as will gum up the machine and increase the friction, where the object is to decrease it.
6. It should contain no ingredients which will corrode or pit the metal.

In considering the qualifications to be added to these general requirements in order to define application to the mechanical conditions of cylinder lubrication, it is necessary to consider the questions involved in the operation of an internal combustion engine, which are different from those of any other type. What I have to say now may appear very elementary from a mechanical standpoint, but unless it is mentioned, the important bearing which it has upon lubrication will not be as obvious as I want to make it. After a charge has been taken into the cylinder on the suction stroke it is compressed to form 50 to 75 pounds before being fired. Naturally upon the starting of the compression stroke there is a tendency for the gasoline mixture to leak. There are two ways of obviating this difficulty, of securing full compression. These two ways might be stated as mechanically secured compression, formed by the close fit between the piston or piston rings and the cylinder wall; or compression secured by liquid seal, which means the use of an easy clearance between the piston rings and the cylinder wall and the sealing of the space between them by the use of a proper kind of lubricating oil. In respect to the mechanically secured compression the following points are worth noting as axioms which must be taken into consideration in estimating the conditions:

1. The closer the fit, that is, the less the clearance between the piston and cylinder walls, the more the power absorbed in turning the engine over. In fact, it is possible to secure perfect compression in this way only by securing so tight a fit that the mechanism will not turn. Even in practise good compression can be secured only at the sacrifice of some of the effective power.
2. The closer the mechanical fit between piston and cylinder walls the thinner a lubricating oil which will work its way between them. The thinner the lubricating oil the greater will be the wear and tear, because of the impossibility of keeping the metal surfaces apart where the clearances are so small and the lubricant must be such a slight film.

With these conditions, when wear and tear has once begun, every stroke of the engine increases the loss of compression, the consumption of lubricating oil, the consumption of gasoline, in proportion to the amount of power, and, in fact, decreases continually the efficiency of the motor. You will readily see the impossibility of securing and maintaining maximum efficiency under the conditions.

(Continued on Page 482.)

MARMON 1500-POUND DELIVERY WAGON.

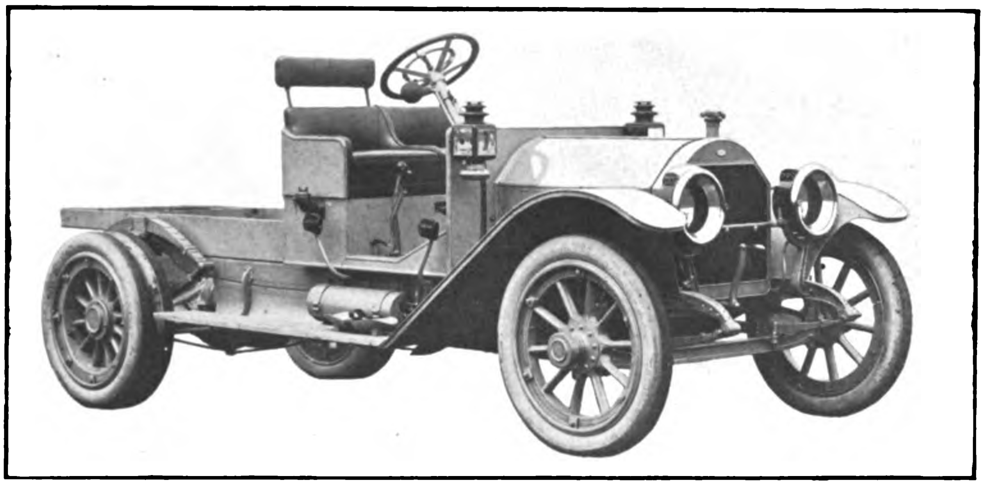
THE Marmon delivery wagon of 1500 pounds capacity, built by the Nordyke & Marmon Company, Indianapolis, Ind., is placed in the market with the assurance of the maker that it has been developed for the service for which it is adapted with more than usual care. The company has built pleasure vehicles for years, and has been engaged in machine manufacturing for three generations, an experience that is reflected in the Marmon passenger cars and is quite as noticeable in the delivery wagon.

The Marmon wagon is not in any manner radical. In fact it accords with standard practise so far as principles are concerned, and examination will impress one with the proportions of all the members and the quality of workmanship. The materials are of high grade and the design has been worked out to secure a combination of simplicity, accessibility and endurance. All wearing parts have been made of generous size with means for compensating wear, and provision has been made for sufficient lubrication wherever surfaces have frictional contact.

The motor is typical of Marmon design and construction, but differs from the pleasure car engines in that it has a bore of four inches and stroke of five inches, the horsepower rating being 25.6 by the S. A. E. formula. It is a T head, four-cylinder, water-cooled construction, and it is maintained that it is built as heavy as is the average 40 horsepower machine. The water jacket is large and the valves and ports are designed to insure sufficient charges of fuel and complete scavenging of the cylinders. The crankcase is a barrel form without supporting arms, which shape makes for accessibility and permits work and attention with minimum labor on the water pump, magneto, carburetor, oil pump and the connections.

The lubrication system is positive and has been tested for years in the Marmon cars. The crankshaft is drilled and the oil is fed by a pump to the three main bearings into the crankshaft, then through the connecting rod bearings and through tubing on the connecting rods to the wristpin bearings. The flow is through a sight feed on the dash and a float gauge indicates the quantity of oil in the reservoir. The other moving parts of the motor are lubricated by splash and the oil thrown off by centrifugal force. The motor is suspended on the main frame of the chassis at three points and is so installed that there is a straight line of the shaft, giving the highest efficiency and least loss from friction, angularity of shaft, and other incidental causes. The motor is governed so that by the automatic control of a valve in the fuel intake a speed in excess of 20 miles an hour is never attained. The governor is enclosed and the cover may be sealed to prevent a change by the driver. The governor is driven from the inlet camshaft. The motor is fitted with an acetylene gas starter. The ignition is by a high-tension magneto and battery, a dual system using one set of spark plugs over the intake valves. There is a single coil with a lock installed on the dash. The carburetor is an automatic float feed type that may be adjusted from the dash. The motor is cooled by a circulation of water through a cellular radiator mounted in trunnions on the chassis frame, and radiation is promoted by a large fan driven by a flat belt carried on an adjustable bracket at the front of the engine. The motor is installed under the regulation hood of sheet metal with a centre section bolted to the radiator case and the dash.

The clutch is a cone with the wide face covered with asbestos fabric, with a series of springs beneath the facing to prevent harsh engagement, a construction that affords positive results and long endurance. The transmission gearset is a selective type sliding gear having three forward ratios and reverse, assembled with the differential in the rear axle assembly. The shafts are all mounted in ball bearings and the gears are very wide face. The rear axle is a full floating construction with a pressed steel trussed housing, the design being the Marmon standard, the wheels being carried on the ends of the housing and driven by shafts bolted to the outer flanges of the wheel hubs. The differential is heavy and is designed to have long endurance. It is accessible by the removal of the rear cover plate of the axle housing. The front axle is a forged steel I section with large steering knuckles with annular ball thrust bearings. The spindles are fitted with roller bearings.



The Marmon 1500-Pounds Capacity Delivery Wagon with Open Express Body Equipment.

The frame is a pressed steel channel section with heavy cross members, well reinforced with gussets. The forward springs are semi-elliptic, 36 inches length and two inches width, and the rear springs are full elliptic, 38 inches length and two inches width. The

machine is driven from the right side by an 18-inch hand wheel through a gear of the irreversible worm and nut type. The tail lever and the drag link and tierod are liberal in size and are special heat treated forgings. Spring cushioned ball joints protect the gear from road shocks. The tiebar and the connections are behind the axle to afford protection. The control of the ignition and fuel supply is by levers mounted on a quadrant on the steering wheel. There is a foot accelerator. The left pedal operates the clutch and the right pedal the service brake. The gearset changes are made by a hand lever that is operated in an H slotted quadrant. The brakes are an expanding type operating within pressed steel drums on the rear wheels. The brake shoes are 16 inches diameter and two inches width, there being a total of 403 square inches of braking surface, and are made of alternate segments of asbestos fabric and a composition metal. The brake shoes are interchangeable and their operating mechanism is protected, but adjustment is easily made. The wheels are of wood, artillery type, 34 inches diameter, and are shod with 34 by four-inch solid or pneumatic single tires forward and single or dual tires rear. The rims are quick detachable demountable.

HARRIS OILS PROTECTED.

United States Courts Enjoin the Use of Patented Name by Two Western Concerns.

The A. W. Harris Oil Company, Providence, R. I., has secured two perpetual injunctions that prohibit the use of the name Harris in connection with lubricants offered for sale that would create the impression that these were the products of that company, the first against the Parker Refining Company, and the second against James C. Harris of Muncie, Ind.

The petition for injunction against the Parker Refining Company was presented to the United States district court for Ohio and this set forth that the petitioner had used the name Harris in connection with the distribution of oil since 1885, that the name was registered in the United States patent office, and that its business reputation was built on the public knowledge of Harris oils. Judge William L. Day in this case made decree that the registration of the name was good and valid at law and that the Parker Refining Company had infringed upon the exclusive rights of the A. W. Harris Oil Company, and issued a perpetual injunction prohibiting the Parker Refining Company from using the name Harris in connection with the sale of oils, and from its use in advertisements or upon labels, or the use of any word of similar sound or appearance.

In the United States district court for Indiana Judge Albert R. Anderson decided that James C. Harris of Muncie, Ind., doing business as the Harris Oil Company, had improperly used the name Harris without properly distinguishing it from the name of the complainant and that the defendant had copied advertisements of the complainant. He made decree perpetually enjoining James C. Harris, his agents or associates, from using the name Harris or Harris Oil Company in connection with the business of selling oils, or in advertisements, unless preceded by "James C." and followed by "of Muncie, Ind.," in the same size and style of type, and unless accompanied by some statement showing that the oils sold are not the original oils sold by the A. W. Harris Oil Company; from copying the advertisements of the A. W. Harris Oil Company, from using containers similar to those used by that company, from copying any of the distinctive designs of that company, and from offering to sell oil in any manner that might give the impression that it was the original Harris oil of the A. W. Harris Oil Company.

SEPARATE ACCESSORY SHOW.

Manufacturers Considering Exclusive Display During the New York Exhibition.

The question of continuing exhibition in connection with the next annual show of automobile pleasure cars at Grand Central Palace, New York City (there will be no truck display in that city or Chicago next year), or of holding a separate exhibit at Madison Square Garden concurrently with the vehicle show, is now being considered by the executives of the Motor & Accessory Manufacturers. The proposition to be determined is whether or not the interests would be best conserved by a separate show. Should the exclusive display be decided upon for members and others engaged in the manufacture of similar products the motorcycle and motorcycle parts makers will be invited to participate. In such an event no automobile vehicles will be shown, and neither would there be exhibits of accessories, motors, parts, supplies, equipment, etc., at the Grand Central Palace show. There will be no change, however, with reference to the Chicago exposition, and the members of the Motor & Accessory Manufacturers will show in connection with the exhibition of vehicles at the pleasure car exhibit. The Motor & Accessory Manufacturers now has an option on Madison Square Garden for a show, and will continue this until a decision is reached.

The H. J. Koehler Sporting Goods Company, maker of the Koehler delivery wagon, has produced a second model or type, the principal change being the use of 36-inch diameter artillery wheels fitted with demountable rims instead of the 48-inch rear wheels which was the original equipment. The new machine is also equipped with a standard automatic float feed carburetor, a Bosch magneto and other similar high grade auxiliaries and accessories. The original type of wagons, with 48-inch rear wheels and two-inch tires, will be continued, with some refinements.

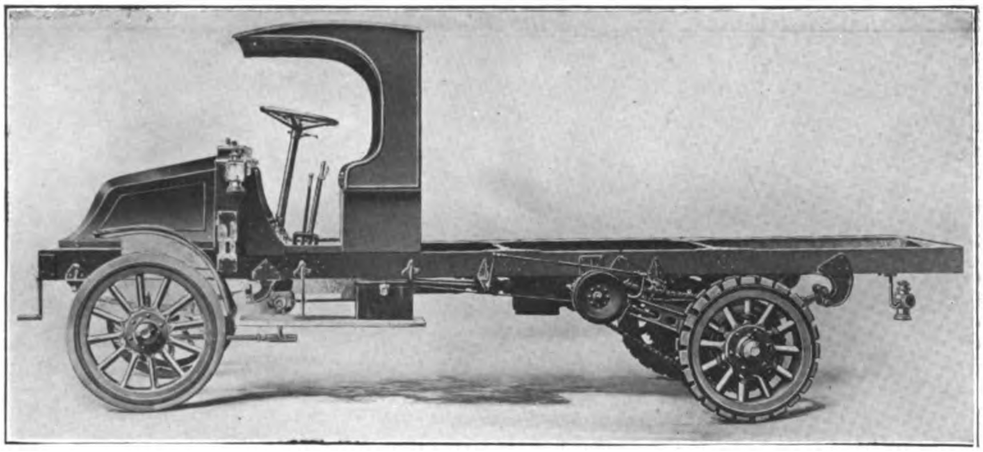
THE WILLET TWO-TON WAGON.

THE Willet Engine & Truck Company, Buffalo, N. Y., is building a two-ton delivery wagon, the first of a series of sizes that it purposes to produce. The machine has been carefully developed and it is maintained that it has unusual simplicity, extreme endurance and the working parts have been so greatly reduced that the care and attention has been minimized. The two-stroke cycle type of engine has been adopted, and this is a special construction that has features not to be found in any other. The design has been patented and it is the exclusive property of the Willet company.

The engine differs from conventional two-stroke cycle motors in that rotary intake valves are used, it being claimed that these valves are self-grinding and self-adjusting and require practically no attention. The design of the motor is unusual from several points of view. The cylinders are cast en bloc with the cylinders separate from the water jacket to the base flange. The head of the block is cast separate, this being cored for a generous water space. In the block the water jacket is open the full length and width of the casting, the spaces being very large. This construction permits clearing the water jacket of every obstruction, affording perfectly free circulation.

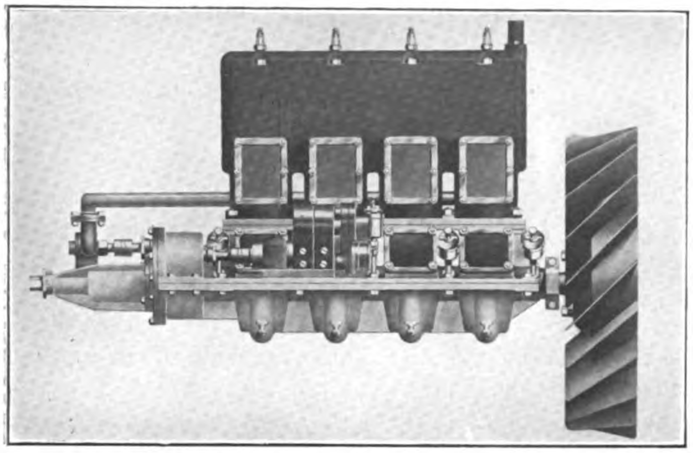
The head of the water jacket is a plate that is slightly crowned and it is retained by a series of cap screws. There is a single outlet at the extreme rear of the block. The exhaust manifold is cored into the block and it is covered with a ribbed plate, to which the exhaust pipe is coupled at the rear of the block. The water intake is at the base of the jacket, practically under the exhaust pipe connection. The base flange of the block is continuous and this is drilled for bolts at the ends and between each cylinder at either side. The engine base is in three sections, the upper and lower halves and an extension that covers the forward end of the crankshaft and forms a cover for the timing gears. In the upper section are large plates covering handholes through which main and crankpin bearings may be examined or adjusted. The lower section is formed to have four transverse channels or pits into which the big ends of the connecting rods swing, and which take the drainage of lubricant from the interior of the engine case. Large flanges are at either side of the case, which materially stiffen it.

The bore of the cylinders is 4.5 inches and the stroke is five inches. The engine is rated by the maker at 32 horsepower, but the rating by the S. A. E. formula for a four-cycle engine is 32.4, and if the usual 50 per cent. is added this gives a total of 48.6. The crankshaft is a steel drop forging, case hardened and ground, 1.75 inches diameter, and it is mounted in five bronze bearings, the front bearing being 3.625 inches length, the centre bearings 2.5 inches length, and the rear bearing 3.625 inches length, this giving a total bearing length of 14.75 inches. The crankpin bearings are two inches length. Each main bearing is lubricated by a grease cup. The forward extension of the crankshaft carries the timing sprockets from which the outside magneto and the pump and valve shafts are driven by silent chains. The valves are connected with the intake manifold and these will permit a predetermined volume of fuel to pass into the crankcase, where it is compressed and taken into the expansion chamber through the usual ports. These ports are covered with plates that may be removed should occasion require. The lubrication is by feeding the oil in the fuel in the proportions of one pint of lubricant to five gallons of gasoline. The fuel is carbureted by a carburetor that has fixed adjustment and in which there are no moving parts. The engine is cooled by a centrifugal pump of conventional type, the intake manifold being carried to the forward end of the motor and then back to the rear end. The radiator is a flat tube type that is mounted on springs on the main frame forward of the dash and is protected against damage and from the strains of chassis distortion. The ignition is by an Eisemann high-tension magneto. The motor is installed in the frame so that the lower section rests on the hangers, there being no strains on the bolts connecting the sections of the case.



The Chassis of the Willet Two-Ton Delivery Wagon, Standard Length, with Driver's Cab.

The clutch is a leather faced cone with a series of flat springs beneath the facing to insure ease in engagement. The drive is by shaft to the selective type Brown-Lipe transmission gearset, which is assembled as a unit with the jackshaft. The forward end of the gearset case is supported by a frame cross member, and the jackshaft is mounted with the outboard ends in heavy hangers. The gearset has three forward speed ratios and reverse. The shafts are heat treated nickel steel, and the gears, with inch faces, are heat



The Left Side of the Willet Two -Cycle Motor, Used in the Willet Wagons.

treated chrome nickel steel. The bearings of the gearset are Timken type, of large size. The drive from the jackshaft is by side chains.

The frame is a channel section of pressed steel, six inches width, and the cross members are large and reinforced by gusset plates. The front cross member is slightly curved and serves as a bumper. It is detachable and interchangeable, and may be quickly replaced if damaged. The springs are Krupp silico manganese steel, semi-elliptic, of extra length, and the bolts are very large and are hardened, ground and fitted with grease cups. The front and rear axle are Timken constructions, the front member being an I section and the rear rectangular, both being drop forged steel. These are fitted with adjustable roller bearings. The radius rods are swivelled and adjustable. The wheels are of wood, artillery type, and these are shod with 36 by four-inch single tires forward and 36 by 3.5 dual tires rear.

The drive is left side with the control levers in the centre. The steering gear is a worm and gear type. The usual pedals operate the clutch and the service brake and the hand levers control the gearset and the emergency brake. The service brake on the jackshaft drums is a contracting type, the drums being 10 inches diameter and two inches width, and the emergency brake shoes act on rear wheel drums 16 inches diameter and 2.5 inches width. The gasoline tank under the driver's seat has 30 gallons capacity. The wheelbase is 144 inches regular and 168 inches special construction, with 61 inches tread forward and 65 inches tread rear. The road clearance is 11 inches. The loading space of the standard body is 126 inches length for the regular machine and 144 inches for the special. The chassis frame is 39 inches width and on this bodies six feet inside measurement are installed. The chassis is fitted with a driver's cab with a bonnet extending over the dash. To this a windshield and curtains may be fitted if desired. The equipment includes the oil dash and tail lamps, horn, kit of tools and jack.

The purpose of the company is to produce different capacity vehicles which will have the same characteristics of that described, and will vary only with reference to the proportions of the components.

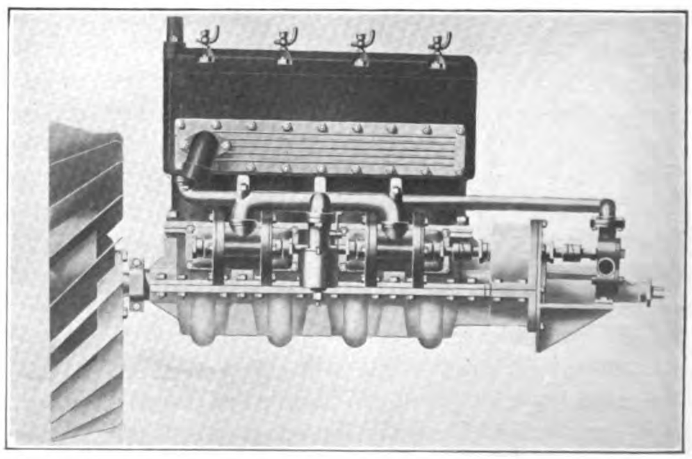
WOULD MOVE ARMY TRUCKS.

Col. E. T. Glenn Explains the Economy of Motor Transportation Over Railroads.

Col. E. T. Glenn of the Twenty-third Infantry Regiment, U. S. A., is an enthusiastic advocate of the government moving its armies by motor truck train instead of railroads, and he has given the subject much careful study. He proposed to the War Department last December that a regiment be moved from Indiana to San Francisco by a train of motor trucks, this to demonstrate the economy and the practicability of the proposition. The proposal was rejected as the War Department did not own sufficient machines.

Col. Glenn has not lost faith in the utility of the motor truck in army transportation, and he recently reviewed the subject before the officers of the Sixth Brigade and Second Division at the Sixth Brigade headquarters at Texas City, Tex., where the general value of the road train in army service was considered and discussed by a considerable number of army men. Col. Glenn has had the co-operation of a number of authorities in the collating of information and has developed plans for moving any number of men any desired distance. He maintains that it is practical to move a regiment of 2000 men across a country in 140 motor wagons at an expense of approximately $10 a mile, carrying 18 men to a vehicle and having a sufficient number of machines to carry the impedimenta. He believes in the mobility of the army carried by motor truck transports, and that there is decided advantage in being able to place a large body of infantry at a given point, not too far distant from the base, in the time that would ordinarily be required to make up and start a special train. Col. Glenn claims that motor truck transportation would cost about half the expense of using railroads. With such equipment an army would be practically independent of all the usual means of travel and communication.

Such truck trains would be practical for use under all conditions and would be extremely serviceable save in the event of quick mobilization at distant points, when railroads would be the most expeditious.



Right Side of the Willet Motor, Showing the Mechanism Operating the Rotary Valves.

WHITE TRACTOR IN LUMBER HAULAGE.

THE possibilities of power wagon use are seldom understood, even by those who have carefully studied the subject of transportation. Theoretically the motor wagon can only be used on highways, and the better results from every point of view obtain with the smooth and level road. Being constructed for operation on solid and comparatively even surfaces, there is no doubt that the greatest ratio of work and the largest economy will follow use where these conditions exist. The experience with the power vehicle has demonstrated that the better highway is imperative, and the use of machines designed for pleasure has educated the public generally to this requirement. That good roads are necessary for the realization of pleasure from the use of automobile vehicles has been so constantly emphasized that the public is now educated to the full value of perfected highways, and to maintain that power wagons can be worked where the ways are rough and unimproved, or where roads do not exist, appears to controvert every fact that has been impressed upon the people by experience and theory.

For years makers, owners and drivers of automobiles have sought to attract attention by using or driving machines where the conditions have been in reverse of what have been suited for legitimate use, but while such demonstrations may have established the endurance of a construction or the skill of the driver there is little probability that any person has been convinced that vehicles could be used under such circumstances for any length of time. Not only this, the cost of experiments of this character is generally so great that measured by any standard of publicity the actual return is exceedingly doubtful.

The use of the power wagon or truck is not necessarily confined to smooth highways or to the paved city street, but the mistake made by practically all who utilize machines on anything else than ideal ways is in neglecting to adapt the vehicles to the conditions of service. By this is meant that the truck or wagon, designed for work on the improved road, might be more economical were it adapted for the work to be done, but obviously the designer cannot produce special machines at the prices of stock productions, and the impracticability of building types that might be adapted for varying purposes is evident. Upon reflection there is little probability that any one will take issue with this statement. Those who consider the use of machines today are generally limited by the designs and constructions from which choice can be made, and instead of having just what can be worked to greatest advantage and economy as a rule endeavor is made to do work with what would be decidedly more efficient were it adapted for the express purpose.

An illustration of this statement is found in the use made of a five-ton White truck by a lumberman. The man is Theodor Kundtz of Cleveland, O., whose operations are carried on in the southern part of Cuyahoga county, that state, near the Brecksville station. The work that this man does differs somewhat from ordinary lumbering, where timber is cut and the land cleared indiscriminately, for his policy is to select trees that will yield the class of timber desired, to fell these and to haul the logs to the railroad station, whence they can be shipped to the customer. In other words, his business is furnishing special lumber, which is selected, cut and delivered.

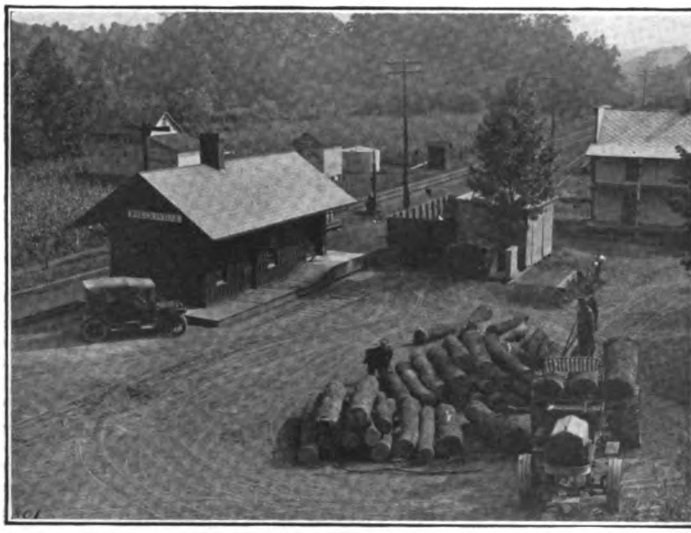
Hauling the First Log of a Load Onto the White Truck in Theodor Kundts's Timber Land.

Hoisting the Final Log of a Big Load with the Power Winch and Skid Poles.

Where it is possible to do so lumbering on a large scale is carried on near rivers, and generally in winter, so that the logs may be hauled with sledges on snow and piled on the banks so that they may be floated down the river with the high water of the spring. Sometimes industrial railways are built and the logs hauled by animals or small locomotives to the nearest river, and occasionally to railroad stations, and where the railroad is the means of transportation work can be carried on the entire year. Mr. Kundtz's business is not what would be considered large, but it

is of material proportions. He had used horses for a considerable period and he conceived the possibility of using a large truck to haul the logs from the forest to the railroad. He realized that it would not be practical to use a truck as built for road service, and he was uncertain what could be built for him. He consulted the engineers of the White company at Cleveland and stated to them the work he wanted to do and why he could not use a truck of the stock type.

The tractor engine might have been used, but such a machine must necessarily haul trailers, it is more difficult to handle in a forest because of the length, it is not as useful on the road, and with it the trailer must be loaded by manual labor. Mr. Kundtz wanted to have a single unit equipment that would have the power of the tractor and the mobility and usefulness of a truck, and while the machine he required cannot be compared with the logging train, the railroad was impossible for his purposes because of the peculiar character of his business. The log train would have large tonnage capacity, but it would be necessary to haul the logs to the track and load them, while he desired to have a truck that could be driven anywhere in the forest and loaded, this minimizing handling, and this machine could be driven on the roads, which would not be possible with a logging locomotive.



Unloading the Truck at the Log Pile at Brecksville, Six Miles from the Loading Point.

The White Truck Hauling a Six-Ton Load of Hardwood Timber Through the Forest to the Highway.

The engineering department of the White company began with a five-ton truck as a basis for development. Instead of the usual four-cylinder motor a six-cylinder engine was installed, this having great flexibility and abundant power, and the front member of the chassis frame was carried forward in semi-circular form to afford protection for the radiator and engine. Then special axles were built, for the front and rear wheels are special. The front wheels are the standard White cast steel construction, but they are fitted with steel tires which have a centre ring or flange that prevents side slip. The tires are wide, so as to be sufficiently supporting on soft ground. The rear wheels are the regular tractor type with 22-inch steel rims and round steel spokes that are mounted at either side of the wheel hub, where they are adjustable, and fitted to the rim a considerable distance apart. In the centre of the outer surface of the rim is a ring of steel, and from this at an angle of perhaps 20 degrees flat cleats extend to the edge of the rim, stiffening the rim and insuring traction on any surface. With the supporting rim width of 44 inches the truck may be driven with a full load over very soft ground. Of course the tread is much wider than that of the standard truck. The gear ratio is greatly reduced, so that the tractive effort is largely multiplied, and a load of six tons can be drawn over the ground in the woods without excessive strain upon the machine. The top speed is approximately eight miles an hour.

The truck or tractor is fitted with a power winch that is driven off the transmission gearset shaft, this being installed transversely and operated with a hand lever. This winch is really a necessity in handling the big logs, for with rope and chain tackle and skids 1000 feet of timber has been loaded in 20 minutes. Much of the wood handled is hard, such as oak, walnut, hickory and ash, and this is picked out and felled, sometimes in places almost inaccessible, where the truck must be driven with extreme care, especially when loaded. Timber of high grade, necessary for superior cabinet work, commands special prices, and wood that might not ordinarily be handled because of the difficulty of hauling is often a quality that is particularly desirable. Where timber is in ravines or in places where the truck cannot be driven close to it the winch and tackle can be used to haul it near enough to load, or the truck is hitched to tackle and the machine driven so as to haul the logs where they can be loaded. The work could be accomplished with horses or portable engines, but the cost would be very much increased.

Hauling from five to six tons for a load the truck makes trips between the forest and the Brecksville station that average about six miles. The loads are either piled close to the railroad siding or placed on

cars, the winch being used for raising the logs from the ground on skids or from the truck. With the truck a car can be quickly loaded, so that it has an efficiency that could be realized with no other equipment. The logs can be piled until cars are in readiness, so that the truck can be kept busy. After a year's service in all conditions the machine can be regarded as well tried, and it has been found equal to expectations in every way. The result from this special truck bears out the statement that when a machine has been adapted to meet unusual requirements it will have at least the same relative economy that it would have under the ordinary conditions of use.

COMPETING WITH RAILROAD.

Motor Truck Line Established to Serve Farmers Producing for Philadelphia Market.

The Diamond-Keystone Supply & Transportation Company, with a capital of $100,000, has been formed at Philadelphia, Penn., to operate a dozen or more motor trucks between Philadelphia and lower Delaware over the old King's highway, and transport the fresh fruits and vegetables, eggs, poultry and butter in less than a day from the small farms of Kent and Sussex counties to the city.

The idea is to deliver these fresh supplies early every morning to the green grocers and storekeepers direct, so that residents of Philadelphia can be served with fresh produce without the intervention of the middleman and the jobber or huckster. On the return trip of each of the five-ton trucks, freight and merchandise which the farmers do not produce themselves, will be carried south, thus lessening the cost of operations by getting revenue both going and coming. During the winter during every favorable hauling day, apples, celery, sweet potatoes, lettuce, eggs, poultry, pork, butter, etc., will be hauled.

William H. Saunders, a mechanical engineer, is a leading spirit in the venture. He conducted a farm in Sussex county and thoroughly investigated conditions. The concern will also agitate for the building of good roads. Heretofore there has been little if any competition with the Pennsylvania railroad's one line of transportation and farmers have habitually complained of losing their profits in freight rates.

The Muir shock shifter, the invention of an Englishman, by which a series of balls convert road shock into power, is being tried on a Velie truck.

ONE CHEESE A TRUCK LOAD.

Unique Demonstration Made in San Francisco Streets on Federal Machine.

The California Central Creameries specializes butter, cheese and dry milk, and recently as a demonstration of the possibilities a cheese weighing 1500 pounds was produced. Of course the only value of this enormous product was the public attention that it would attract, and just how to realize the fullest measure of publicity was a problem that was carefully considered. While exhibition at different places was logical enough, the main purpose was to bring to the knowledge of the people that this cheese had been made.

San Francisco, the largest city of the Pacific Coast, was the first place for display, and so the mammoth cheese was shipped there. Then it was placed on a Federal truck, and with the machine carrying signs and with the cheese stencilled in large characters, it was hauled through all of the streets in which the vehicle could be driven. The display was continued for several days, and then the cheese was shown in a store, where it was viewed by many thousands of people who had seen it on the wagon, or had learned of it through those who had seen it.

Federal One-Ton Wagon Carrying a 1500-Pound Cheese Through the Streets of San Francisco to Exploit High Grade Products.

An unusual use was made of a Reo two-ton wagon by A. F. Fifield of the Reo Sales Company, St. Catharines, Ont., who pulled down the walls of a brick barn on his property with grapplings and chains, the machine being a mechanical "Samson" for the occasion.

John N. Willys, president of the Willys-Overland Company, Garford Company and Gramm Motor Car Company, has appointed George W. Bennett vice president and general manager of these concerns. Mr. Bennett's headquarters is at Toledo, O.

The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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Information given on request. All advertising copy must reach this office not later than the 25th of the month preceding.

Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

Entered as second class matter, February 25, 1911, at the Postoffice at Pawtucket, R. I., under the Act of March 3rd, 1879.

TAXING THE MOTOR WAGON.

Following the example in Massachusetts, inaugurated by the state highway commission, several states have this year proposed to tax the owners of motor service wagons for the use of the highways, this being based on the theory of a license issued by the state by the authority of assumed police power. But whatever the pretext, the proposition resolves itself into a means for increasing revenue. The conclusion is, apparently, that the owner of a freight automobile ought to be compelled to pay for the maintenance of the highway in addition to his regular contributions through taxation.

The highway authorities as a rule are in office through political preference. Taxation is a burden unless the other fellow pays for it. Logically it is practical to impose a heavy registration tax, especially if the opinion of the people can be based on a very general desire to escape from every possible form of tax. In Massachusetts an argument to limit the weight of the vehicles and load to 12 tons is the condition of the bridges, which are assumed to be too light in many instances. Unless controlled by the state the towns must maintain the bridges. To strengthen existing bridges and to build in future what will be adequate for the present needs of road transportation, the towns, the distinct beneficiaries through the use of vehicles carrying large loads, would tax all forms of motor wagons and deny the use of the highways to those which would be productive of the largest economy for those owning them. What has been attempted will be repeated in 1914 and the motor wagon interests of every character should organize for protection and force every candidate for the legislature to declare himself. In the event of failure to obtain such declaration the candidate should be defeated. The place to decide this proposition is at the polls.

SERVICE AND MAINTENANCE.

The selling organizations throughout the power vehicle market are making great efforts to impress upon the users and owners of machines and those studying the economies of such equipment the value of "service," and the relation it has to the economical use of all motor vehicles. The purpose is undoubtedly praiseworthy, but the result sought would be the better accomplished if "service" and "maintenance" were exactly defined. That is to say, if there were a precise knowledge of what constituted "service" and "maintenance" and each vehicle manufacturer, his representatives and agents, were bound by general acceptance to afford whatever was included in "service," and the owners would know just what they would have to pay for as "maintenance." Without a clear understanding of what is implied by either word there is no doubt uncertainty in the minds of thousands as to what they can justly expect from the manufacturers, and this being so there are those who assume they are discriminated against when they are denied what they may want, no matter what the claim. Without question there are those who honestly believe they are entitled to more than they receive; there are others who are satisfied with the attention given, while some claim as service practically everything that could be included in maintenance, and do so with a hope of getting something for nothing.

DRIVING UNLOADED MACHINES.

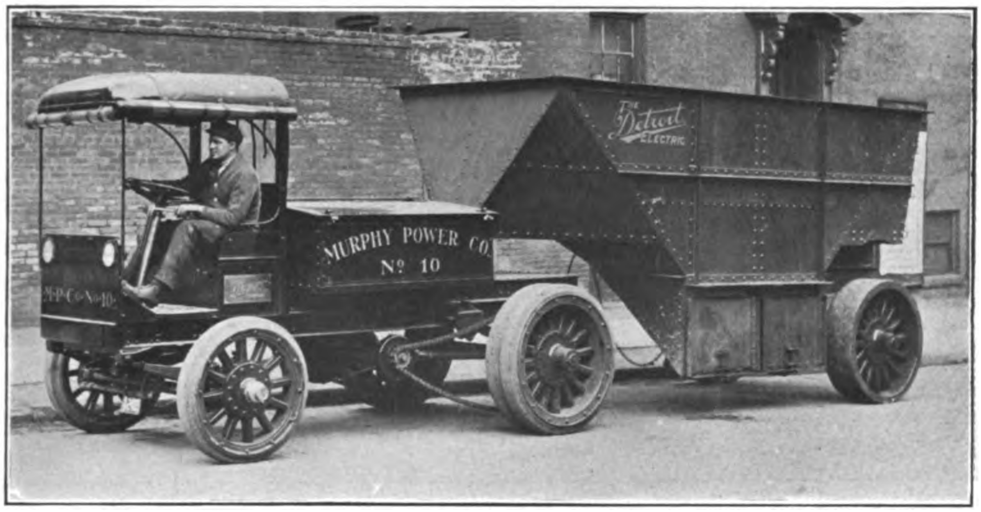
The owner of any motor wagon or truck should be certain how his machine is driven when unloaded. For the abuse of fast driving when light, and when the vehicle may be subjected to the extreme stresses of road shock, the driver is generally, if not always responsible, in like proportion to the owner who permits overloading. The machine may be driven well toward its limit when the road surfacing is smooth, but when on block or similar paving the pace should be minimum. The mistake is usually made of pounding a vehicle over rough highway, when as a matter of fact there is frequently distinct loss of time in loading and unloading. While there is no doubt of the wisdom of keeping a motor wagon moving, the speed should be made by those operating it—in reducing the standing or idle time to the lowest point practicable. How this may best be accomplished may be a problem of considerable proportions, but when once worked out the saving is continuous and, better than all else, the service is improved.

ELECTRIC COAL TRACTOR.

Twelve Tons of Fuel Hauled at a Load by a Detroit Industrial Equipment.

The economy of large load haulage impelled the Murphy Power Company, Detroit, Mich., to install an electric tractor and trailer to transport coal from the yards of the concerns supplying it to the plant of the company. The proposition was to haul as large loads as was practical, and, because it was proposed to utilize electric power, to have such trailer body equipment that there would be a minimum of time required for loading and unloading. The requirements were made known to the Anderson Electric Car Company and a tractor was designed by the engineering department which was approved and constructed.

As will be noted from the accompanying illustrations the tractor does not differ generally from the design of Detroit vehicles, other than that the chassis is short and jackshaft is carried very low, the jackshaft sprockets being very nearly, if not quite, on a line with the rear axle. The rear axle is heavy and the rear wheels are large. The short chassis and the position of the motor and jackshaft necessitated the location of the battery box in the chassis frame, the covers of the box being slightly inclined to insure drainage. The forward end of the body of the trailer is coupled on a pivot at the rear of the tractor chassis. The body is designed for gravity discharge from one or two side gates, and the form is such that the coal will settle to these gates as the body is emptied. The body is constructed of steel plates and angles, being reinforced wherever necessary. The trailer wheels are shod with wide steel tires and the tread is wide to insure stability, because of the unusual height of the body. The capacity of the trailer is 12 tons when fully loaded.



Twelve-Ton Detroit Electric Tractor, Built for the Murphy Power Company, Detroit, Mich.

ELECTRIC TRUCK IN ARSENAL.

Driven 35 Miles Daily in the United States Magazines at Frankford, Penn.

In the United States arsenal at Frankford, Penn., a one-ton G. M. C. electric wagon, a driver and two men are now doing a work for which three single horse wagons and 19 men were required. The men are paid an average of about $2 a day, and the cost of the electric current necessary to operate the machine, which is produced at the arsenal, is less than a cent a mile.

Previous to the acquisition of the electric wagon raw and finished material was transferred from the one department to another, some of these divisions being separate buildings, by hand trucks and horse wagons. This meant that the materials were collected in a building on a floor truck and drawn to a doorway, where a wagon was loaded. The load was taken to another building where it was removed and then distributed by the hand trucks. One driver was required for each wagon, and the other men loaded and unloaded the hand trucks and drew them about. The ammunition is packed in cases that weigh from 150 to 250 pounds, and this is largely the finished product of the arsenal.

As the electric wagon may be driven in the different buildings where ammunition is manufactured, provision was made to utilize it to the fullest extent by the construction of ramps or runways into the ground floors of the structures, and so the machine is driven into them, loaded and unloaded in quick time. The hauls are all short and the handling of the freight is expeditiously done, for the truck is not usually worked more than from 8 in the morning until 4:30 in the afternoon. The speed of the wagon is 11 miles an hour. The average expense for current has never been more than 30 cents daily.

It will be understood that the wagon has been made to take the place of the hand trucks formerly used, and that half the handling of raw and finished materials has been eliminated because of the safety of the machine. Figuring the saving of the wages of the men and the expense of the horses it is very evident that the electric will soon save its cost.

One of the large commercial motor vehicle orders that has been recorded in the industry this season has been received by the Knox Automobile Company, Springfield, Mass., from its San Francisco agent, the Reliance Automobile Company. This order is for six Knox-Martin tractors on a total contract for 15, which are to be delivered as fast as the factory can build them. Another order for two 10-ton tractors has been received from Sacramento, Cal. The company ordering the 15 machines will operate them in the oil fields, where Knox-Martin tractors have attracted attention.

NEW ENGLAND ELECTRIC MEN CONVENE.

Central Station, Vehicle Manufacturing and Allied Interests Meet to Promote the Systematic Development of a Field Unequalled in America--Co-Operation to Insure Service and Practical Exploitation Results.

THE New England convention of Central Stations, Electric Vehicle Manufacturers and Allied Interests, arranged by the New England Section of the Electric Vehicle Association of America and the Electric Motor Car Club of Boston, held at the Engineers' Club, Boston, Mass., May 20-21, was the first gathering in the history of the motor vehicle industry where manufacturers and distributors and the producers of energy met for the purpose of generally promoting business and stimulating activities that will be productive of greater utilization of machines.

The Electric Motor Car Club of Boston is a very active and aggressive organization, and the officers and members have for two years systematically endeavored to educate the people of that city and vicinity to the economy and endurance of the electric wagons and trucks, and to the simplicity and luxury of the electric pleasure car. The New England Section of the Electric Vehicle Association of America includes practically the membership of the Boston organization, which is made up of central station representatives, branch managers and agents for manufacturers of machines, batteries, motors, electric devices, appliances, accessories and central stations, manufacturers, representatives, etc., outside of Boston.

Delegates to the New England Convention of Central Station, Manufacturing and Allied Interests at Boston.

The purpose of the convention was to bring together those not identified with or active in the association, who might profit through the greater use of machines, especially those who represented the central stations, for it is believed that with the realization by central station interests that there will be profit in the sale of current there will be such co-operation as will materially increase the use of electric vehicles.

The convention was held in three sessions, the first given over to the discussion of "Electric Vehicle Progress," the second to "Salesmanship and Service" and the third to "Advertising." At each of these pertinent papers were read, and these were followed by discussion, the intention of the officials of the convention being to obtain constructive suggestions and ideas that might be submitted to the executive committee of the New England Section and to the Electric Motor Car Club of Boston with a view of formulating policies and systematizing endeavors that would lead to positive and direct results.

The co-operation of the central stations with the manufacturers and agents for electric vehicles has been advocated by those who have given the subject careful study because it is believed that unless the central station, which is to profit by the sale of current to the user of electric machines, shall give such assistance as is practicable, those who might purchase vehicles would hesitate to do so. It has been maintained that logically each central station can use electric wagons and trucks for service and maintenance work, and that this use is justified because of the economy. Having legitimate and economic reasons for utilizing these machines, supplying current that might otherwise be non-productive, the central stations must necessarily have garaging facilities which could be made sufficiently large to give a public service. With a public garage, which could be handled with a comparatively small force of men, and with employees experienced with batteries, motors, etc., there would be a distinct source of profit because patronage would be impelled.

Perhaps the greatest handicap to a proposition of this character is the general desire of all managers to make a profit from money invested, when it would hardly be practical to make an electric garage profitable until a sufficient number of customers had been attracted and been taught by experience that the ma-

chines were given the service paid for. Undoubtedly a small organization can care for a garage of large proportions, and it is conservatively estimated that a man can secure a greater measure of economy by patronizing a public service if he has less than 10 vehicles. But a very small number of men can care for 50 or 60 wagons and cars. This being so the central station can, when a garage has been established, reduce the cost of maintaining its own transportation equipment materially, supply current without the construction of private installations, encourage the use of machines through practical care and attention, and develop a business that is certain to be continuously profitable. But like any other business that is primarily dependent upon the endeavors of those promoting it, profit can only come when customers have been attracted.

In New England there are a number of central station garages, among them being those at Boston, Hartford, Lowell, Salem, Worcester, with others in prospect at New Bedford, Springfield, and possibly other cities. These have been developed along different lines and policies, and the experiences of those conducting them are varied. The officials of these companies have had sufficient confidence in the future of electric machines to establish public service stations when making provision for their own transportation departments, and in each instance this has been followed by the increase of number of vehicles in use. The desire of the promoters of the convention was to bring together as many as possible of central station men, manufacturers and representatives, with a view of learning if possible a level on which all could co-operate and create an understanding as to the attitude of each with refence to the policies of the other.

The convention was undoubtedly productive of a great deal of good. More than 150 different delegates were present and there was a desire to discuss every proposition from every angle. The uncertainty of the commercial possibilities of New England brought forth the suggestion that two men be selected, both experienced with electrics, the one a pleasure car and the other a service wagon expert, who should visit every locality in the six states to make surveys as to local conditions, to ascertain definitely the facilities and attitude of the central station, and to carefully determine the probabilities for business, they to make report to the association, submitting the data for the benefit of any of the members who might care to utilize them. This suggestion was very generally approved. With the manufacturers the main problem is to learn where they may locate agents, and the central men are equally desirous of knowing how far the manufacturers will co-operate in the development of business.

Another question carefully considered was that of service, there being so wide a variance to the expectations of the users of vehicles, the builders of machines, the agents and the central stations, that the delegates wished to reach a reasonable definition of the term and differentiate it with maintenance. From all points of view there was agreement that the purchasers were entitled to care and attention, and the belief of the manufacturers was that the central stations ought to be willing to co-operate to the extent of inspecting vehicles, advising the users of them, and of making rates for current that would encourage and not discourage those owning machines. The central stations, however, were inclined to believe that the manufacturers of vehicles should not expect them to give some of the attention that would ordinarily be given by agents or branches because of the sale of current, but should contribute a definite amount of the purchase price of machines, for instance, that would compensate the stations for the expense of the service given.

May 20-21, Gathered at the Ball Field, Bass Point, Nahant, to Witness the Struggle for the Championship.

Those present agreed that service was the greatest and most potent factor in the promotion of the sale and use of electric machines. Wherever service could be given the machines increased in numbers and gave satisfaction. Where service is not afforded the reverse of this is true.

The convention was arranged by a committee made up of these committees: E. S. Mansfield, chairman; O. G. Draper, secretary. Entertainment, Day Baker, chairman; E. W. M. Bailey and D. C. Tiffany. Headquarters, Leavitt L. Edgar, chairman; Robert C. Gregg and Edmund H. Hewins. Programme, H. F. Thomson, chairman; E. R. Davenport, George W. Holden, Howard T. Sands and F. D. Stidham. Finance, Mor-

ton J. Fitch, chairman; J. A. Hunnewell, Fred M. Kimball, S. Fred Smith and Albert Weatherby. Invitation and attendance, Eugene Carpenter, chairman; F. W. Smith and John A. White. Review, Frank N. Phelps, chairman; E. D. Dodge, H. S. Knowlton and Frank J. Stone. Publicity, O. G. Draper, chairman; John F. Mahoney, Charles F. Marden, John D. Murphy, George L. Parker, Howard Reynolds, Charles F. Roberts, Frederick G. Roberts, James T. Sullivan and A. W. Talbot.

The morning of the first day from 10 was given over to registration and the reception of the delegates by the committee. The first session was begun at 1 in the afternoon, the company being called together by Chairman Mansfield, who announced the first subject and introduced Fred M. Kimball as the presiding officer of the convention. Mr. Kimball's introductory remarks were substantially as follows:

Chairman Kimball's Opening Address.

Gentlemen: I welcome you here on behalf of the New England Section of the Electric Vehicle Association of America and the Electric Motor Car Club of Boston, and trust you will find your attendance pleasant and profitable. We have met for wise deliberation and frank, full and friendly discussion of ways and means of promoting the scope and enlargement of the electric vehicle industry, the success of which means so much to us and to the people of our country. Very great progress in the introduction of the commercial vehicle, particularly, has been made during the past year, and there is every reason to expect still greater activity and progress during the coming year. It seems to me that among the more important objects of our activities are

First: An effort to popularize the electric vehicle with the small tradesman, the artisan and the family of moderate means, for the electric carriage is a vehicle for woman's use as much as for man's; to develop a demand that can be met by a standardized product that can be built in quantity and, therefore, at a cost which shall permit a selling price more comparable with that of the horse drawn equipment. I think you will probably agree with me that a greater number of commercial electric vehicles are "made" than are manufactured at present. More varied and widespread use of standardized types of vehicles and quantity production is the "key to success" in this particular direction. In this regard we can well take a leaf from the book of experience of our friends in the gas car business. Those who require heavy trucks and wagons, and those who require special construction, usually can and will pay a price commensurate with the cost of serving their needs, but the grocer, the laundryman, the butcher and the baker need simply a reliable, sturdy vehicle of moderate carrying capacity, at an initial cost and annual maintenance and operating charge within the reach of a pocket book none too plethoric. A business built up on the production and sale of vehicles of this character, however, when once established, dealing with large, continuous and duplicate production, can be made very attractive.

Second: Attention should be concentrated on providing a wider distribution of garage facilities which will be available to the class of customers referred to above. Garage service must be prompt, effective and honestly and fairly conducted. While the use of the mercury arc rectifier and the rotary rectifier has made it possible for the owner of a small pleasure or commercial vehicle to do his own charging, the owner of a commercial vehicle usually lacks the dispositon, the time, the knowledge and the means to adequately care for his battery and the inspection and up-keep of the vehicle itself during the first year's use at least. Improved garage facilities will do much to assist in enlarging sales of the types of vehicles required by tradesmen, and I am rather hopeful that by a suitable campaign of education, livery stable keepers may gradually be induced to add facilities for charging and garaging electric vehicles, so that ultimately adequate service may be found, even in all our smaller towns. Proprietors of livery stables must appreciate that the horseless vehicle has come to stay. It would seem to be part of wisdom for them to recognize the situation and meet the new demand half way. The electric carriage can be garaged and charged in buildings heretofore devoted to caring for horses, with substantially no changes or additions, and in this respect the stable keeper can much more easily provide for electric garaging than for garaging gas cars.

Third: To the central stations we must look for the most moderate rates they can safely adopt. Our larger city stations for the most part are already making rates which are attractive and helpful, but in the case of many of the smaller stations there is a lack of appreciation of the ultimate gain which will almost certainly succeed the apparent present loss. Rates are frequently held at a prohibitive figure, and only an indifferent service is provided.

Finally, we all—manufacturers, owners of garages and central station managers—must strive for economies in our business. Inefficiency of labor, the high cost of all material used in our industry and the deadly "overhead" charges, in particular, unite to make the problems of achieving popular prices for vehicles and service a most difficult one.

Day Baker, Treasurer, Electric Vehicle Association of America.

Fred M. Kimball, Chairman, Presiding Officer of the Convention.

Harvey Robinson, Secretary, Electric Vehicle Association of America.

Mr. Kimball then read a paper on "New England as an Electric Vehicle Field," which was retrospective, emphasizing that these states might properly be regarded as the birthplace of the modern electric conveyance, showing the part New England men and interests had taken in its development, calling attention to the possibilities for its use for pleasure and in industry, and pointing out that there were some special uses, such as milk and ice distribution, that were seemingly of very large promise.

The paper was briefly considered and then the second paper, "The Growing Popularity of Electrics," written by H. H. Rice of the Waverley Company, Indianapolis, Ind., was read by F. F. Rogers of New

York City. This paper was discussed to some length and it was followed by the paper of L. R. Wallis on "Central Station Service for the Owners of Electric Cars," which was taken up in the absence of W. C. Anderson, whose contribution to the programme was deferred until the evening session. This paper was as follows:

Central Station Service for the Owners of Electric Cars.

In the majority of cases the purchaser of his first electric of either type knows comparatively little about those essentials of operating, maintenance, care and charging, which it is necessary for him to understand in order to insure the successful operation and satisfactory performance of his battery driven machine. It, therefore, devolves upon some interested party to provide the information and render the service required for its intelligent installation and operation. The logical agencies for the undertaking of this work are the manufacturer or his representatives, the central station and the owner.

We will assume that the owner is willing to use what knowledge and facilities he may possess for the most efficient handling of his property, but he may rightfully look to the manufacturers from whom he purchases his car and equipment and the central station which supplies him with electric current for charging to co-operate in providing such service as is necessary to assist him in making his electric a success. From an electric motor car standpoint the interests and responsibilities of the manufacturer and central station are very closely allied and it becomes difficult to differentiate between the character of service that each should render as in many instances each interest stands ready to offer the electric car user service along practically the same line. Geographical and financial conditions often become instrumental in determining just where the line of responsibility should be drawn.

In the large cities where the manufacturers are ably represented and a strong central station company exists, the question of service should be of such a character that the methods employed would not need discussion as each interest will doubtless be willing to offer the user practically the same assistance. In smaller cities and towns where the central stations are not in a position to engage actively in promoting the electric vehicle, if the field is considered a promising one, the manufacturer should assume the larger part of the burden until the business grows to such an extent that the central station will be automatically forced into it, while in such territories as are remote from the factories and lack adequate factory representation, the central station should strain a point to foster the industry during the introductory period, after which the volume of business will warrant the manufacturers in establishing sales agencies and maintenance departments in those sections.

In any event there should be a tacit understanding between the manufacturer and central station as to what part of the service each is willing to assume and a compromise agreed upon covering such details not previously arranged for, so that the efficiency of the service will not suffer.

If a distinct line were to be drawn between the service to be rendered by the manufacturer and the central station it would appear to be equitable to make the division on the basis of instruction and supervision of that portion of the equipment supplied by each. According to this rule the manufacturer would advise as to the size and type of the machine to be purchased, the battery and motor equipment and other details necessary for the satisfactory performance of the work required, while the central station, if sufficiently informed, might properly act in an advisory capacity to approve the recommendations of the agent. The manufacturer should also have charge of the maintenance of the machines after they have entered service and direct the manner in which they should be charged and cared for.

The central station should deal with the customer in matters relative to the supply of charging current, the rate at which it is sold, the proper charging apparatus to be installed and in the capacity of a consulting engineer in case the operation of the electric should be unsatisfactory, or the cost of such operation should prove excessive. In justice to the user, however, in each case it should be clearly understood what portion of the service is gratuitous and what is to be charged for.

To be a bit more specific the selling agent of the manufacturer should seek out the prospect, bestow upon him the necessary time and attention and provide him with full information concerning his product; he should study his conditions and requirements in order to convince first himself and then the prospect whether or not the electric will satisfactorily perform the service required. If the results of the investigation are favorable to the electric he should put forward his best efforts to effect a sale. The central station should then be notified of the sale with full information as to name, address, type of machine, size of battery, etc. This is important in order that the central station may study the situation from its standpoint and be ready with service by the time the car arrives. On the arrival of the car the manufacturers' agent should instruct the owner or his driver to a full understanding of its construction, the most effective and efficient operation of the machine, the care necessary for its most successful performance and familiarize him with the care and charging of the battery necessary for its maximum life and mileage. He should provide regular inspections and arrange for speedy delivery of repair and renewal parts in case of necessity.

The central station on being advised of the sale of a car should at once get in touch with the purchaser for the purpose of learning his requirements and advise the best methods of caring for and charging his car either at a public garage or his own charging station. In case of the latter the lines should be run and the service installed. The central station should be in a position to recommend the best charging apparatus for his specific need and render assistance if desired in procuring and installing it in the customer's premises. The electric company should also provide instruction in the best methods of using such apparatus and the most economical manner of using the current. Regular inspection of the electrical apparatus should also be made to insure constant service, safety and satisfactory performance.

The central station should establish a rate for charging current which, while profitable to itself, should be low enough to meet the requirements of battery charging, realizing that this branch of its business requires service during the period of its valley load. Although the foregoing may be considered a legitimate division of responsibility between the manufacturer and central station, it is self-evident that the line should not be drawn too rigidly, as in many instances the two interests can work conjointly not only for the increase of sales, but for the betterment of the service and the greater satisfaction of the user.

Co-operation is the key note of success in the electric vehicle as well as in every other business and where the various agencies work in harmony there the best results will be obtained. The central station can well afford through advertising and publicity to educate the minds of the public along the lines of the superiority and advantages of the electric and thus augment the sales of the agent, and he in turn can easily increase the business of the central station by friendly advice to the purchaser and wisely designed sales.

The central station can render valuable service to the manufacturer as well as the user by maintaining a department of vehicle and battery engineering, whether it consists of one or more individuals whose function it is to bring the prospect and agent together for their mutual benefit and to safeguard the interests of each after the sale has become consummated. Service after the sale is of the utmost importance by whomever rendered and is the secret of the repeat order.

Another important feature of service which should be undertaken by the central station is the purchase and use of electric vehicles of both types, in its own transportation, to an extent warranted by the size of the company and character of its business. In this manner only can the central station obtain the data necessary to intelligently foster the interests of its customer. The moral effect of putting into practise the advice given to prospects cannot be thoughtlessly ignored. It is the province of the central station either to establish public charging stations under its own auspices or use its influence to induce others in its territory to open electric garages or add electric charging apparatus in an already established garage. The majority of the owners of passenger electrics and fleets of commercial electrics will desire to support their own charging facilities, but it is essential that public charging stations be available to provide boosts and render maintenance service when called upon to do so.

As a step in the right direction in anticipation of a more satisfactory arrangement, facilities should be arranged at the main power station where electrics may be charged at any time during the 24 hours. The subject of a public electric garage is one of the utmost importance during the introductory period of the electric vehicle, for without such an institution the agent finds it very difficult to interest his prospects, and even if a sale is made the owner passes through a very discouraging period of experimentation on account of the superficial knowledge possessed by those directly in charge of the machine.

In an increasing number of instances central stations have deemed it expedient to maintain public electric garages either in connection with their own fleets or under independent management at another location where owners may receive expert care and advice and there they may feel free to come in cases of unsatisfactory performance and unknown difficulties. There are few central stations of moderate size who cannot provide some such an arrangement and it will be found that the agents will centre their efforts on the territories which have been made possible in this manner. Whatever else the manufacturers may demand of the central stations they certainly have the right to expect a friendly attitude, co-operation and a warm welcome in the territory served by them.

There will probably be a wide difference of opinion as to the natural division of responsibility between the manufacturer and central station, but we must not lose sight of the fact that the two interests are in partnership for the purpose of supplying the maximum of service to the user with the minimum amount of friction between themselves. Service must be rendered—by whom the user is but slightly concerned, and if each factor in the business is willing to do just a little more than he considers his share no one need have any misgivings as to the future of the electric vehicle.

The conclusion of Mr. Wallis' paper was followed by discussion relative to service and what constituted it, and the value of the co-operation of the central station was set forth by J. C. Bartlett of the Woods Electric Garage, Philadelphia, Penn., who stated his experience with the Public Service Corporation of New Jersey in connection with the establishment of a ga-

rage at Camden, N. J., and who defined service and maintenance as afforded by his own business and the co-operation of the central station as productive of practical promotion. He demonstrated that both the central station and the garage had their responsibility to the owner of the vehicle, and where the obligation was understood and regarded the results were in every way satisfactory. Mr. Bartlett stated that while the line between the service and maintenance was clearly drawn in his business, it was a part of his policy to go even 300 miles away to give to customers the attention they were entitled to. Yet whatever was maintenance was charged as such.

Following the session the delegates gathered outside the club and saw a very large number of electric cars, wagons and trucks driven through Arlington street for their observation, the owners of machines in Boston instructing their drivers to make detour through the thoroughfare.

Constructive Criticism of the Electric Vehicle.

The evening session was begun at 7:30, at which time E. R. Davenport read a paper on "Constructive Criticism of the Electric Vehicle" (from the viewpoint of the outsider looking in.) Mr. Davenport was a very exacting critic and he maintained that the purpose was to encourage discussion and to formulate opinion that might be productive of beneficial results. Relative to manufacturing, the observation was that most builders of electric vehicles were so healthy industrially that they were not disposed to consider conditions they should; that the production was not as large as the size of the plants might lead one to believe; that the large capitalization, big overhead charges and small production necessitated a heavy fixed charge on each vehicle. To this must be added the manufacturing cost and the profit. In reply to the suggestion that if the central station co-operated with the manufacturer the producton would be increased, he maintained that if the manufacturer improved his service and the quality of his salesmen he could materially increase production without demanding so much from the central stations.

He urged that an electric pleasure car, to be sure, that could be sold for about $1250, would be immensely popular and would be bought in large numbers. He recalled that an electric runabout was sold about 10 years ago for $850 that was really very serviceable, and argued that electric vehicles were steadily increasing in price instead of decreasing, while gasoline car builders were decreasing the price or were adding to the equipment with no greater cost. Not only this, the gasoline makers are generally increasing production. He analyzed the cost of the components, concluded that an electric car should be built cheaply and maintained that the central stations were not unreasonable if they asked that the selling prices be reduced. With reference to service machines he did not regard the prices as high as those generally established for the pleasure cars, but believed there should be a radical change in the methods by which these were sold.

Turning to salesmanship he held that it was not wise to appoint a man in Boston agent for six New England states, for while such agency might be profitable the central station cannot be given the attention and co-operation necessary, especially if some distance from Boston. He gave illustrations to demonstrate the need of well trained salesmen, thoroughly informed relative to the machines they sell, who know the conditions in which these will be used, who understand the attitude of the central stations, who can analyze a haulage problem and present the facts in convincing manner, who can advise their customers and can influence business because they know all that a high class man should know. He gave attention to advertising, and pointed out that it was not sufficient to deluge an inquirer with literature, but there should be means for following up and developing the business. He commented on the character of advertising and rejected the artistic as against that which educated, that the electric is a utility and gives data and facts, and contended that the public wants experience data and information that it can prove; suggestions that talk the language of the different businesses, and service all the time.

With regard to service he believed that this was a term that should be well defined, so that there shall be no doubt as to what the manufacturer and agent shall provide, and when a vehicle has been sold attention should be given that will satisfy. How a customer should be taken care of should be clearly understood. He believed that the service responsibility should be shared by the manufacturer, the battery maker and the central station and that the obligation should not be shirked. No matter what the condtions the customer ought to be given a standard service by all three, and a thorough understanding of responsibility would no doubt bring about satisfactory attention and a united endeavor that would be in every way promotive of the use of electric machines. He did not assume how the service expense should be shared by the manufacturer, his agent, the battery maker and the central station, but believed this division was the ultimate solution of the problem. He believed that the service station, operated to give the best care possible to every make of car or service wagon in a given territory, no matter who provided the service or how the expense of it is to be divided, was the first essential to the permanent advancement and progress of the electric vehicle industry.

This paper was highly appreciated and it was followed by a paper on "How the Central Station Can Develop the Electric Vehicle Load," by W. C. Anderson, president of the Anderson Electric Car Company, Detroit. He said in substance:

How the Central Station Can Develop Electric Vehicle Load.

I should indeed be ungrateful if I did not avail myself at this time of the opportunity to publicly express my appreciation as well as that of my associates, at the splendid publicity work which has been done, and general co-operation by the Boston Edison Company in promoting the electric vehicle industry. Its management has been broad minded enough to see that the advent of the electric vehicle in large quantities in this city would effectively solve one of the most vexing problems which the central station has to meet, namely, a constant demand for their off-peak load.

An exclusive electric garage, which I understand, is of the

highest quality, is now being operated by the Boston Edison Company. This garage is fast assuming the characteristics of the ideal station, and will undoubtedly serve as a model to be followed by other central stations who will soon fall in line with this "help each other" progressive movement so general throughout our land.

Since Oct. 1, 1912, the power rates for charging electric vehicles in your city have been reduced more than 50 per cent. Prior to the date mentioned the consumer of current for battery charging paid $10 for 100 kilowatts. Now he may secure the same amount for about $4. The benefits of this reduction in power rates has already been felt by the Edison company in the large increase in power consumption which has followed. The electric vehicle industry has also been greatly benefited.

The Boston Edison Company has set the pace by purchasing and operating 56 electrically propelled vehicles. By this move material evidence is shown the merchants of this city that those of highest authority on electrical matters have put their stamp of approval on the modern electric vehicle. Further, the Edison company has appropriated generous sums for publicity work.

These acts are in strong contrast with the policy followed by some of the non-progressive central stations, who are still living in the dark ages, quite content to operate their business today along the same lines followed by their great grandfathers. There are too many central stations in the East whose managements do not realize that there is a larger profit to them in the electric car than there is in the old horse drawn equipment or gasoline cars. Would you believe, gentlemen, that there are localities within 50 miles of where I stand that are charging 25 cents a kilowatt for electric charging current. We receive many inquiries and personal calls at our Boston branch by those seeking information as to the cost of charging electric cars in certain localities, and upon learning the prohibitive rate they would have to pay the inquirers determine to postpone the purchase of electric cars, and thus sales are lost, resulting not only in loss to the electric vehicle manufacturer, but to the power station itself. Do you suppose that in such localities electric cars will ever be used to any extent under the present circumstances? I say no. There may be a few who care nothing for expenses who will invest, but the buying will never be general there until the central station does exactly what the Boston Edison Company has done, and what the New York and Chicago Edison companies are doing.

I cannot refrain from here mentioning the splendid work which has been started in New York by Mr. Arthur Williams, who has started a co-operative campaign in promotion of the electric vehicle, which substantially within the next few years will surely result in a benefit to his company.

In smaller cities the promotion of the electric vehicle industry by the central station will, of course, be on a smaller scale than in the larger cities. However, their central station manager should use his best influence and give his time to see that a responsible dealer in his city represents a line of electric cars of some standard make. He should offer every encouragement to such a dealer by not only advertising the merits of the electric vehicle in public advertisements, but also should purchase electric cars from him for the central power station work. Help him start his garage right by giving him the service of his engineers, and last, but not least, give him free power for several months until he gets his work built up to a paying basis. In my opinion the establishment of a responsible dealer who is capable and has the proper facilities for handling the electric vehicle business is the first step toward success. If such a dealer cannot be easily located in your city you should take hold of the proposition yourself until a representative of the proper caliber can be found.

We are constantly selling electric cars to owners of gasoline automobiles such as the Packard, Pierce-Arrow, Locomobile, etc. In such cases the owner usually has his own garage and will require the installation of a rectifier or motor generator set with which his batteries may be charged. When such a case arises would it not be a wise move on the part of the central station to give its part of the installation immediate attention, instead of dallying along for several weeks, during which time the new electric car owner becomes disgusted with the entire proposition? The rate charged for current in private garages should be gotten down as low as is consistent with local conditions. When the lady owner of an electric car tells her friend whom she may meet at an afternoon tea that her electric car current bill last month, who drove her car in the vicinity of 600 miles, was less than $10, you may be sure the friend resolves to make a strong point of this fact when she next discusses the matter with the master of the house.

Some of you present may consider it impossible to so cheaply operate an electric car. Gentlemen, I hold in my hand power bills for operating my two electric cars in Detroit which during the past two months cost respectively $5 and $7. The Detroit Edison Company is thriving under these conditions. Its stock is way above par and indications are that it is going much higher.

That there is a just reason for the intensified efforts of the central station manager to promote the use of electric vehicles in his territory, is most ably and conservatively outlined by Mr. H. W. Hillman in his paper read before the Electric Vehicle Association of America on the evening of Jan. 21. Mr. Hillman closed his paper with a statement based on Mr. Edison's prophecy that "with the proper efforts extended by the central stations throughout the country, an increased income to those companies will be realized, amounting to $480,000,000 within the next 15 years."

Aside from the promotion work being done in Boston and New York, much credit is due to other central stations in New England, these including the Northampton Electric Light & Power Company, Northampton, Mass.; Greenfield Electric Light & Power Company, Greenfield, Mass.; Middletown Gas & Electric Company, Middletown, Conn.; United Electric Company, Bridgeport, Conn.; United Illuminating Company and Union Gas & Light Company and the New Haven Gas & Electric Company, New Haven, Conn.; Norwich Gas & Electric Company, Norwich, Conn.; Edison Electric Illuminating Company, Brockton, Mass.; New Bedford Gas & Edison Light Company, New Bedford, Mass.; Lowell Electric Light Company, Lowell, Mass.; Holyoke Gas & Electric Company, Holyoke, Mass.; United Gas & Electric Company Springfield, Mass.; Worcester Electric Light & Power Company, Worcester, Mass., and others who have purchased electric cars for their own use and in other ways promoted the industry.

At Hartford, Conn., the Hartford Electric Light Company maintains a battery department where owners of electric vehicles may rent batteries at a fixed cost per mile or per year, as may be required. This policy relieves the vehicle owner from investing his money in battery equipment, also of the fear so many purchasers seem to have that a storage battery is difficult and expensive to maintain. This policy has resulted in largely increasing the electric vehicles in Hartford. It would be well worth your time to appoint a representative to visit the Hartford station to investigate this particular action.

In every city large enough to support a central power station there are great opportunities for electrically propelled vehicles. If the fabric mills in this territory are not all put out of business because of recent tariff legislation they will still have to transport their raw and finished material to and from depots or boats, as well as cart them about their plant. This work is now being largely done in the former case by horses and in the latter by hand trucks, pushed by laborers. Every effort should be extended by the central station in these localities to see to it that these horses be replaced by electric vehicles, and that the hand trucks be discarded for the electric industrial trucks, which are being successfully operated today by many railroads and industrial enterprises.

Within the very near future, if every central power station throughout the country will put its shoulder to the wheel and push the electric vehicle industry with a force relative to its merit, the problem of "What shall we do with our off-peak production?" will be a matter of minor consideration to the central power station.

Following this paper was discussion, and then came the paper on "Proper Selling of Electric Cars" by Louis E. Burr of the Woods Motor Vehicle Company, Chicago, Ill., which was read in the absence of Mr. Burr. This paper was in part:

Proper Selling of Electric Cars.

In offering this paper I desire to say that the ideas presented are by no means claimed as original, and my only excuse in coming before you is the conviction that the subjects mentioned are important ones and it is possible that some good may come from the fact that they are brought to the immediate attention of the convention, which may result in fruitful discussion of them.

Central stations—I am free to say that the subject of the central station is rather a hazy one to me, insofar as offering new ideas regarding it. I know very little about the central station, what it wants to do—and its ability to perform—but I do know, of course, that the central station of today is very different from the central station of even a very short time ago.

About five years ago a Woods Electric was driven overland from Chicago to Lincoln, Neb., and about that same time another trip was made from Philadelphia to Pittsburg over the mountains, both trips being considered quite remarkable at that time on account of the fact that the journeys were by electric car. During these journeys our men, who made the runs, were hampered a great deal by lack of proper charging facilities and were obliged to resort to all kinds of methods and devices known to the electrician to charge the battery, even when they arrived at a town where there was a central station. The central station manager was invariably courteous and ready to oblige, but as a rule possessed absolutely no knowledge of the method of charging an electric car.

I believe that should these same routes be followed at the present time the conditions—so far as central stations are concerned—would certainly be very much improved, and it is my belief that the campaign of education carried on through the Electric Vehicle Association, and in other ways, has awakened the central station to the great possibility of the electric vehicle business as a source of profit to the central station. I would think that a central station that can afford to would have an electric vehicle of some kind—either a commercial or pleasure vehicle—in its possession for its daily use, to create a desire in the minds of the people to own an electric vehicle, perhaps as much on account of the ease with which it can be cared for and charged as for any other reason. It is a self-evident fact that the price at which current is furnished is a potent argument in favor of the machine and the price should be made as low as possible, consistent with the conditions. In other words—the closer the central station and the electric vehicle dealer can get together the more business there will be for both and the greater the mutual advantage.

Service—The question of service at the present time is, to my mind, a very important one. It is a very much abused word and may be compared with the so-called "guarantee" offered by a great many dealers. A guarantee means exactly what the guarantor intends it to mean—nothing more or less. Service may be catalogued under the same head. The average buy-

(Continued on Page 463.)

THE PHILADELPHIA THIN PLATE BATTERY.

By James M. Skinner.

THE following is the second and concluding installment of the paper read by James M. Skinner, engineer of the Philadelphia Storage Battery Company, before the New York section of the Electric Vehicle Association of America. The first part was published in the May issue of the Motor Truck. The review deals with the characteristics and qualities of the Philadelphia storage batteries in particular and the thin plate battery in general, with particular reference to mileage capacity and longevity:

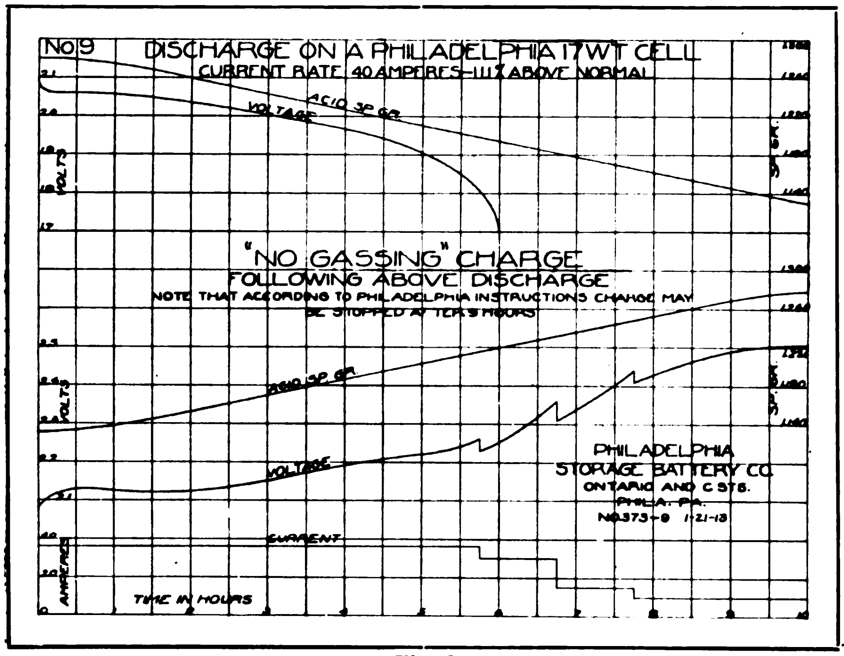


Fig. 9.

Efficiency.

The service watt-hour efficiency of Philadelphia thin plate batteries is upward of 70 per cent. This is based on 44 cells and a charging voltage of 115. Note that the efficiency has been figured from the 115 volts of the charging circuit, and not from the considerably lower average charge voltage across the terminals of the battery, because the current is metered and paid for at 115 volts regardless of the battery voltage.

Considering the proposition of charging from a theoretical standpoint, the more free surface the active material exposes, the easier it will be to charge without gassing. If gassing is not permitted, the ampere-hour efficiency rises close to 100 per cent. With some batteries gassing is a fundamental and necessary thing; the efficiency of these batteries is therefore low. With thin plate batteries gassing is not fundamental nor necessary. Hard gassing is criminal. It is a waste of current and of money, and since it washes the active material off the plates, it is a very good means of shortening the life. It is perfectly possible to charge a thin plate battery with almost no gassing. The Philadelphia Storage Battery Company has for some time advocated a "no-gassing" charging procedure. Where it has been adopted it has resulted in an extraordinary increase in battery life. It is very simple. Each daily charge is started at the normal discharge rate, and the current maintained at this point until gassing commences. The rate is then reduced in several steps, keeping below the gassing point at all times, until the low finishing rate is reached. At the finishing rate gassing is so slight that it can do no harm, and the charge is continued until the total battery voltage has risen to within about two volts and the specific gravity to within five or 10 points of the maximum obtained on the last previous overcharge. Once a week, or in light service, once every two weeks, the battery is given an overcharge at the finishing rate until the voltage and specific gravity have stopped rising for four hours. To illustrate how very simple these "no-gassing" charges are, Fig. 9 has been prepared. This shows a discharge on a 17 WC cell at 40 amperes, 111 per cent. of the normal six-hour discharge rate. Six hours were obtained at this high rate, so the cell was rather fully discharged. The lower curves show the following charge. You will note that only three reductions of current were necessary, all in the second half of the charge. This is not an exceptional case. The charging time can be materially shortened if desired. I have ventured to introduce this instruction book matter because it is vital. When means are at hand to increase the life of batteries from 20 per cent. to perhaps even 100 per cent. in the worst cases, they are of sufficient importance to merit the attention and deserve the support of every person in any way interested in electric vehicles.

It is easier to eliminate gassing on thin plate than on thick plate batteries. Gassing in lead batteries is due to the inability of the charging current to find lead sulphate. Whenever there is any current in excess of the amount which can find lead sulphate on which to expend its energy, that current dissipates itself in breaking up the water of the electrolyte into gas. If the sulphate is situated in the depths of a thick plate or if it is covered over, it is difficult to reach, and gassing and low efficiency are harder to prevent. In thin plate batteries, with their readily accessible active material, gassing is easier to prevent, and the efficiency is therefore high.

Life.

The increased capacity of Philadelphia thin plate batteries has not been obtained at the expense of life. Far from decreasing as the plates were thinned down, the life of Philadelphia batteries has actually increased. Of course, there are a number of incidental reasons why this should be so in service. Batteries today are being more intelligently handled, better charging methods are coming into vogue, cars are better designed and draw less current. But even in the laboratory, under exactly the same conditions of handling, Philadelphia thin plates give longer life than thick plates. The diamond grid is a big factor in long life, and certainly the diamond grid is even more necessary for thin plates than for thick. But all Philadelphia plates are built up on diamond grids, and the increased life of Philadelphia thin plates over Philadelphia thick plates cannot be ascribed to this feature alone, however advantageous it may be.

Disregarding this advantage, common to both thick and thin plates of Philadelphia manufacture, it seems as if there must be certain other qualities inherent in thin plates that make for longer life. Most of these have been referred to in previous parts of this paper.

First, the active material is better distributed, therefore, the internal strains due to discharge are less. This is true even

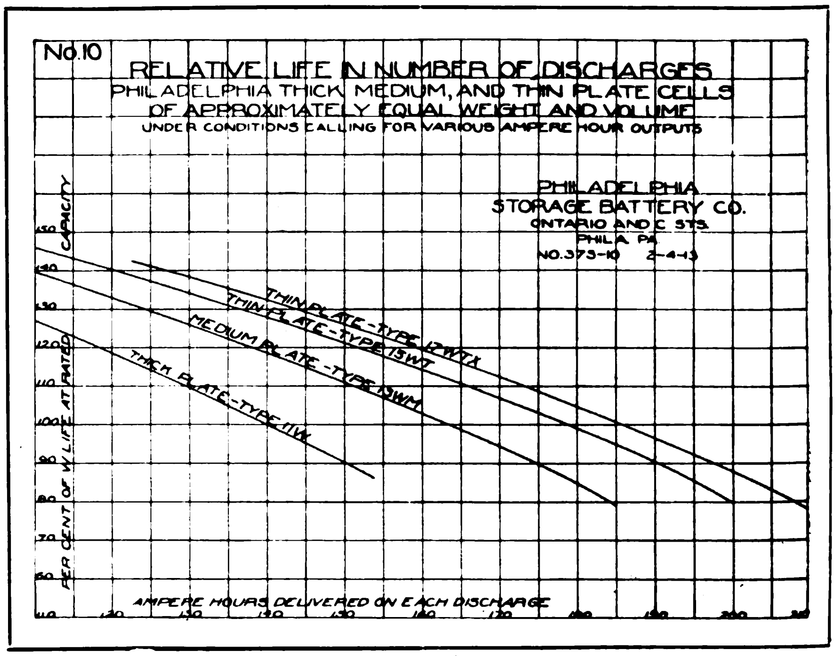


Fig. 10.

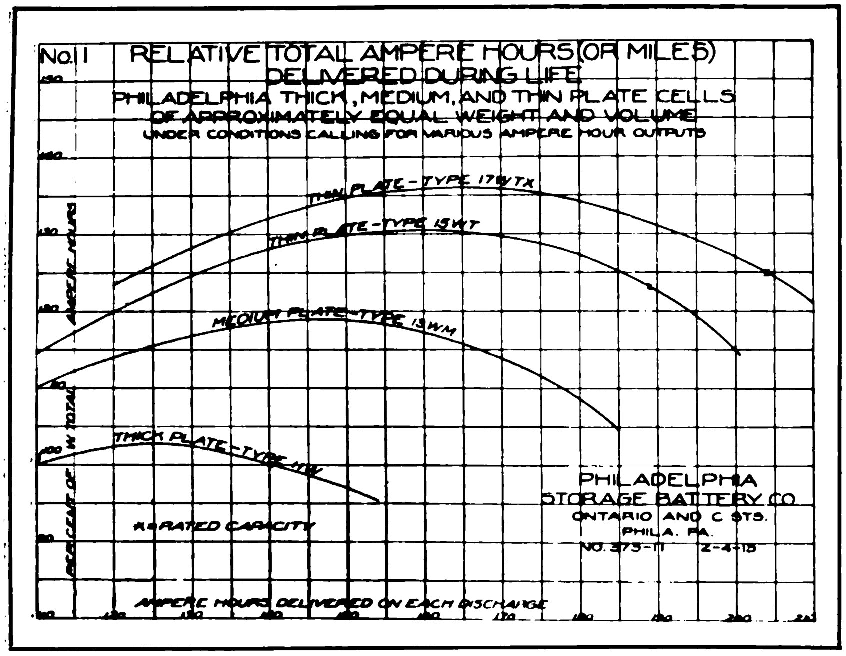


Fig. 11.

of full discharges, and on moderate discharges they are very much less.

Second, due to larger plate surface and the better accessibility of the discharged material, gassing is reduced, and where the "no-gassing" charging method is in use, the wear due to gassing is only a fraction of that on thick plate batteries charged until they "gas freely," as by the old instruction books.

Third, as will be shown later, the growing tendency toward installing larger batteries is having a marked effect in increasing life.

And finally, thin plate batteries maintain high capacity until almost the end of their lives, whereas thick plate batteries have a habit of gradually decreasing in capacity until they give less mileage than the service demands. Furthermore, it is possible to work thin plate batteries to a far lower point, because, even when they have fallen to 70 or 75 per cent. of their rated capacity, they will still give more than full thick plate mileage. It is characteristic of worn out thin plate batteries that they look worse than worn out thick plate batteries, which is to their credit. They have worked efficiently up to their last ounce.

For any given ampere-hour output a discharge, the number of discharges obtained during life increases progressively from W to WTX. This is shown in Fig. 10. Here have been plotted the relative number of discharges obtained from Philadelphia thick, medium and thin plate cells, of approximately equal weight and assembled in the same sized jars, under conditions calling for various ampere-hour outputs a discharge. The 11 W life under rated capacity discharges has been taken as 100 per cent. If discharged only to 11 W capacity, 140 ampere-hours, the 13 WM will give 118.5 per cent. of the W life in discharges, the 15 WT will give 128 per cent, the 17 WTX, 132 per cent. The total miles obtained during life increases in the same proportion. The 11 W will not give 168 ampere-hours, the 13 WM capacity, but if the 13 WM, the 15 WT, and the 17 WTX are run to 168 ampere-hours on each discharge, the WM will give 96 per cent. of the W life in discharges, the WT, 108 per cent., the WTX 114 per cent. If all cells are run to full rated capacity on each discharge the W will give 100 per cent. life, the WM 96 per cent., the WT 91.5 per cent., and the WTX 84.5 per cent., but the WM has given 20 per cent. more miles a discharge than the W, the WT 35 per cent. more, and the WTX 46 per cent. more. If all cells are run to such capacities that they give W life in discharges, the WM will give 17 per cent. more mileage a day than the W, the WT, 27 per cent. more, the WTX, 33 per cent. more.

By multiplying the number of discharges by the ampere-hour output a discharge, there is obtained the total number of ampere-hours delivered during life. This calculation has been made on the four cells of Fig. 10, and the results have been plotted on Fig. 11. The total ampere-hours delivered by an 11 W cell discharging to 140 ampere-hours a discharge has been taken as 100 per cent. You will note that the number obtained is a variable quantity, depending on the cell considered, and upon the number of ampere-hours taken out a discharge. It increases from W to WTX. At any given ampere-hour output a discharge the 13 WM will give more total ampere-hours than the 11 W, the 15 WT more than the 13 WM, and the 17 WTX more than the 15 WT. Each curve has a hump in it. These humps show the points to which the cells should be discharged in order to obtain maximum life in ampere-hours (or in miles). To obtain the maximum life in ampere-hours from an 11 W cell, it should be discharged only to 126 ampere-hours, 90 per cent. of its rated capacity. This is usually impossible in service, because the thick plate capacity is low, and 90 per cent. of it will not usually cover the mileage requirements. To obtain maximum total miles from a 13 WM, 148 ampere-hours, or 88 per cent., should be taken a discharge. This is sometimes possible, because even then the 13 WM will give nearly 6 per cent. more mileage a day than the 11 W. The 15 WT maximum is at 160 ampere-hours, 85 per cent. of its rated capacity, and the WTX at 164 ampere-hours, 80 per cent. of its rated capacity. It is usually possible to install WT and WTX batteries of sufficient size to obtain this maximum life, because even when discharged only to 85 and 80 per cent. of their rated capacities they give 14 to 17 per cent. more mileage a day than the W battery of equal size and weight.

If discharged to full rated capacity each day the WM will give 114.5 per cent. of the W life in ampere-hours, the WT, 123 per cent., the WTX, 125 per cent., while if discharged only to such an extent that maximum life is obtained, the WM will give 19 per cent. more than the W normal life, the WT, 30.5 per cent. more, and the WTX, 36 per cent. more. The differences between the ampere-hour lives at normal capacity, and the maximum lives, are not so large as to be startling—from 4 per cent. on the WM, 6 per cent. on the WT, and 12 per cent. on the WTX—but they are large enough to be worthy of some consideration. Perhaps the desirability of using batteries of the proper sizes for their work will appeal more strongly if the curves are transferred to a dollars and cents basis. This has been done in Fig. 12. The dips correspond to the humps in Fig. 11, only the thin plate cost is lower and the thin plate curves are here below the thick plate curves. When run at rated capacity the WM cost a mile is 91 per cent. of the W, the WT 90.3 per cent., and the WTX 90.6 per cent. When run at a capacity so as to give maximum total mileage the WM cost a mile is 12 per cent. less than the W, the WT, 14 per cent. less, the WTX, 17 per cent. less, despite the fact that in each case more miles a day, more days of service, and more total miles are obtained.

This matter of maximum life is very important. To make it even more clear, Fig. 13 has been prepared. This shows the relative number of discharges and total ampere-hours obtained from WT cells, when discharged to different percentages of rated capacity. As before, to obtain maximum life in ampere-hours, 85 per cent. of rated capacity should be used on each discharge. If more than 85 per cent. is used, the cell will give fewer discharges and a slightly smaller total ampere-hour output; if less than 85 per cent., more discharges but a smaller number of ampere-hours than the maximum will be obtained.

The proper time to adjust the size of the battery so as to obtain the maximum total output and the lowest cost a mile is before the purchase. It is a much harder proposition to adjust the work to the battery than to initially adjust the bat-

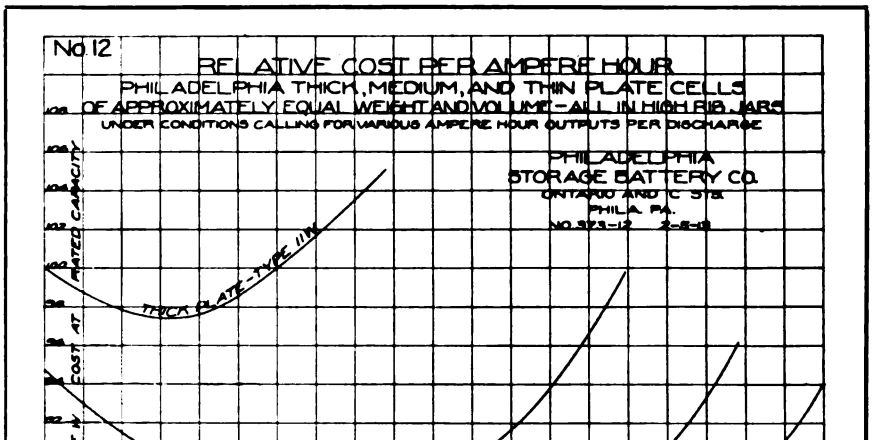


Fig. 12.

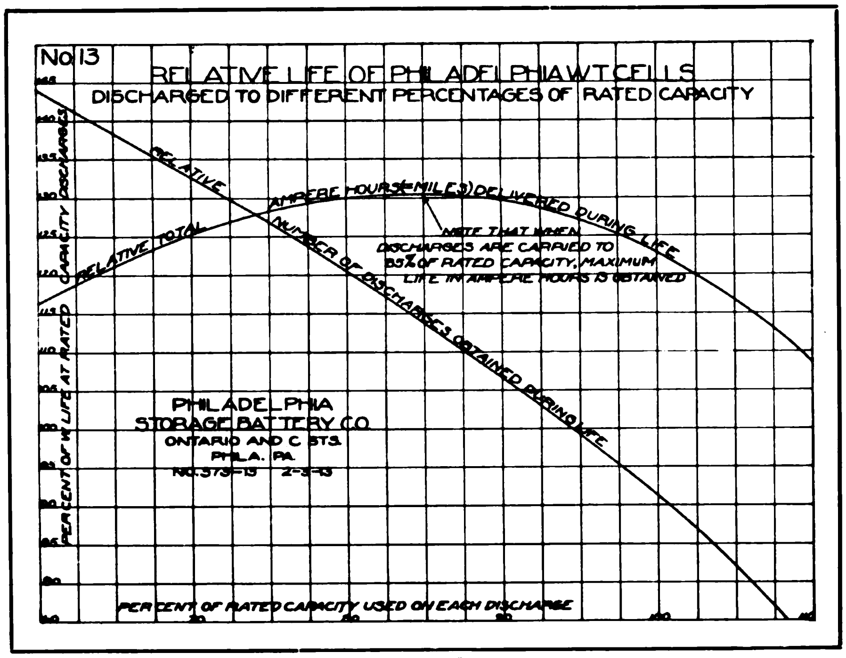


Fig. 13.

tery to the work. If the battery is already in the car and the car must do 50 miles a day, the battery will in most cases have to give the 50 miles, whether it thereby discharges to 60 or 100 per cent. of its rated capacity. But the better way would have been to have first figured out how many ampere-hours the 50 miles required, divided this figure by .85 in the case of WT batteries (.88 for WM or .80 for WTX), and to have determined the size of battery according to the result obtained.

Fig. 14 shows curves plotted from a little more extended calculation along this line. Here it is assumed that 200 ampere-hours are required a discharge, and it is desired to install the size of WT battery which will most cheaply do the work. The horizontal scale in the sketch shows the rated ampere-hour capacities of the cells that might be installed. The vertical scale is divided into per cent. The curve starting at the lower left hand corner shows the relative number of discharges which will be obtained from the various sizes. The figures for this curve are obtained by determining the per cent. of rated capacity to which each size must be discharged in order that it should give 200 ampere-hours, and then determining, from the curve on Fig. 13, the life in discharges obtained when discharging to this percentage of rated capacity. Since 200 ampere-hours are required on each discharge, regardless of the size of cell, this curve also shows the relative total ampere-hour or mileage output obtained from the various sizes. The cost a mile curve is plotted from the results obtained by dividing the catalogue price for each cell by the relative mileage obtained from it during its life. You will note that the 19 WT, which, to give 200 ampere-hours, must be discharged to about 85 per cent. of its rated capacity, shows the lowest cost a mile. The figures for this cell have been taken as 100 per cent.

It is impossible this evening to give more extended figures. Those shown will serve to indicate the general procedure to be followed in economically adjusting a Philadelphia battery to the work it must perform. If further data is desired, we will be only too glad to supply it individually upon application.

It must not be thought that it is forbidden to use the full capacity of Philadelphia thin plate batteries. If exceptional mileage is required it may be advisable and necessary to use all the capacity the battery can give, and the results obtained, even under these conditions, will be good, but the life will be somewhat longer and the cost a little lower if matters can be adjusted so that somewhat less than full capacity is demanded. Our idea in presenting the figures covering this point is not to make it a hard and fast rule that just so much capacity, and no more nor less, must be used, but merely to indicate how the best results may be obtained.

Besides making for longest life, reserve capacity has other advantages. Every car is likely to meet extraordinary conditions which require more ampere-hours than usual. Bad weather, exceptionally long runs, and overloads are of not unusual occurrence. Reserve capacity in the battery is then a very valuable asset. Because of their high capacity, thin plate batteries can generally be installed so as to have sufficient reserve to meet these unusual demands, thereby adding to the day in and day out reliability of the car. It is the thin plate reserve that "gets there" under any conditions.

Service.

The average life of Philadelphia thin plate batteries, in electric truck service, under all sorts of conditions, is about 16 months, and is steadily increasing. Where the methods of handling are good, 20 months is the average, even in hard service, and cases of two years and over are not uncommon. In pleasure cars the life is usually greater. When the "no-gassing" method of charging and the growing tendency to install larger batteries become more general, we have no doubt that even in commercial service a life of 20 months or more will be average.

Just one more point before I close. Philadelphia thin plate batteries are adapted to every kind of electric vehicle service. They will give exceptionally high mileage, but they are not to be used only where high mileage is desired. If the mileage requirements are low, fewer plates may be used, or the battery may be charged only every other day, or perhaps twice a week. This is good practise in light service. If the service conditions are unusually severe, a Philadelphia thin plate battery is required all the more. Hills and bad roads have no terrors for it. High discharge rates will not hurt it. Current can be withdrawn at as high a rate as the service demands. I want to emphasize this point of general adaptability. There is no kind of electric vehicle service to which Philadelphia thin plate batteries are not adapted.

The Independent Torpedo Company, Findlay, O., which deals in nitro-glycerine and other high explosives, uses a Reo delivery wagon in connection with its distribution, and has 12 Reo two-passenger roadsters that were bought for delivering torpedoes and material in the states of Indiana, Ohio, Illinois, Kansas and Oklahoma.

Two three-ton Kelly trucks, made by the Kelly-Springfield Motor Truck Company, Springfield, O., are being used by the Merchants' Express of Bridgeport, Conn. These vehicles run on regular schedule between Bridgeport and nearby cities every day. Each averages more than 70 miles each day.

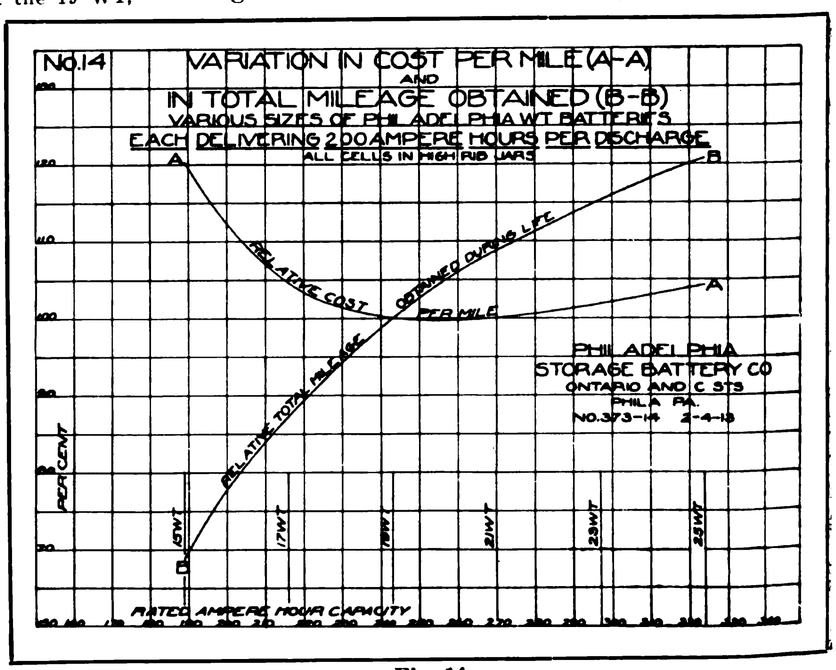


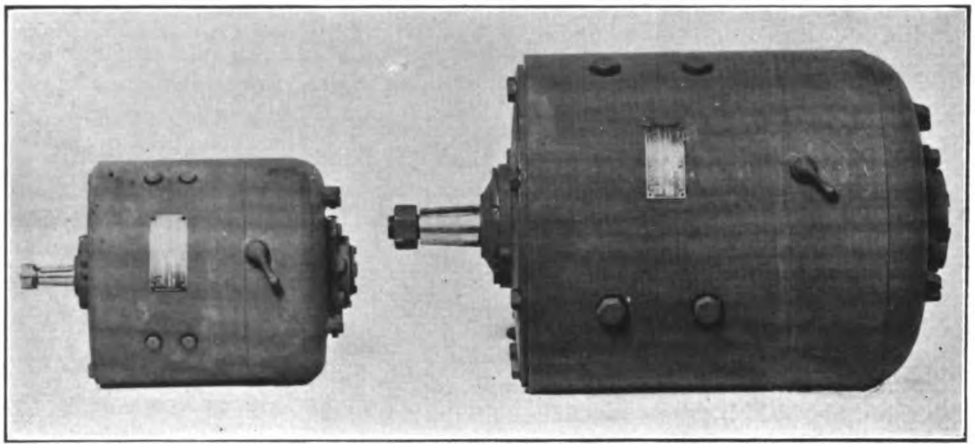
Fig. 14.

ELECTRIC VEHICLE PRACTISE.

The Construction of the Universal Motor of the General Electric Company, a Standard Type of Equipment, and the Processes of Building to Insure Endurance and Efficiency---Extreme Care in Making Commutators and Armatures.

William W. Scott.

WITH rare exceptions the motors used for electric vehicles are made by manufacturers who specialize in electrical equipment, and generally these have been designed with careful knowledge of the conditions of service in which they will be used. It is hardly necessary to point out that some of these concerns produce thousands of motors annually, and have large experimental and engineering departments, with the best of facilities and almost unlimited resources for development. Naturally the designs are made with exact knowledge of requirements, and with the experience resultant from the production of different types and the observation of many thousand machines it is entirely reasonable to assume that the motors are in every way efficient, economical and enduring. Everything depends upon design. The engineering departments are required to produce numerous sizes and greatly differing proportions to accomplish specified works, and with the precise calculations possible with electric units of measurement it is not too broad a statement to say that practically any desired result can be obtained. These manufacturers have admirable shop facilities and equipment, and the workers are experienced and skilled, so that motors supplied to a number of vehicle builders ought not to vary with reference to capacity and service. By this is meant that a standard make of motor ought to be equally as serviceable in any vehicle in which it is found.



Comparative Sizes of the General Electric Universal Automobile Motors, the Smaller Known as GE-1028, Weighing 150 Pounds, and the Larger, Known as GE-1027, Weighing 660 Pounds.

The subject of motor design is extremely important with the manufacturer of such machines, but the purchaser of a vehicle need give himself no concern as to quality. He has bought what has been developed and built with extreme care, and is sent out as factory perfect. It is not necessary for the man who is considering a purchase to take up motor design. This has been gone into by the vehicle builder and the motor manufacturer, and it is reasonable to assume that the latter has placed at the disposal of the former the knowledge and advice of his engineers. The purchaser of an electric machine need have no doubt of the work that will be done by the motor, for it will be equal to every demand made upon it, and it will endure many years with reasonable care and attention.

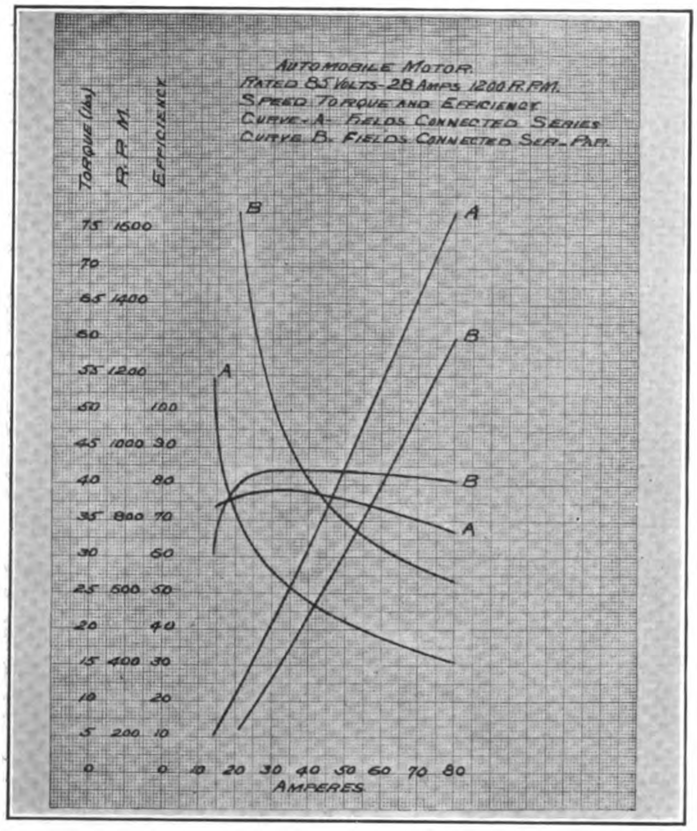
Attention has been directed to the fact that the electric motor has been a dependable machine from every aspect, and the ideal of the engineer has been to produce what will have efficiency and economy, long endurance, and be as cheap as is consistent with a standard of manufacturing. The history of each concern producing a well known motor demonstrates that there has been improvement in designing, in materials, in workmanship and manufacturing methods, but the principles apply to each quite as well as to any one. Some of the manufacturers have processes of treatment, and in some instances proportions, which are maintained to insure efficient and economical results, but these, while regarded as valuable to those possessing them, are details rather than essentials of construction.

There are limitations to the work that can be done with a motor of given proportions. The speed affords power and vehicle motors have maximums ranging from 900 to 1500 revolutions a minute. The power is dependent upon the voltage, and this may be 40 with a very small and very light carriage, or from 60 to 85 with the heavy truck. Taking the series wound motor, the greater the load the less the speed, and the less the load the greater the speed, there being that characteristic of practically automatic control through the load carried. With the old constructions when plain bearings were used the only possibilities for wear were the armature shafts and the bearings, but with the present design, with annular ball bearings, only the bearings can wear, and with sufficient lubrication the only probable bearing defect may be a broken ball or a worn ball race. This probability is exceedingly remote, however.

The only rotating part of a motor is the armature, and mounted on ball bearings it is intended that it

shall be balanced. To its movement there are but three influences for retardation, the friction, the air resistance upon the surface as it revolves, and the load. The load may be carried direct in line with the armature shaft or it may be moved through reduction gearing. The only portion of the armature that may wear is the commutator, which, however, ought theoretically to endure for an indeterminate period. From the viewpoint of the electrical engineer the well designed and constructed commutator should not wear, and under normal conditions a set of brushes should give service for several years.

Every vehicle motor installed today is a housed type, being enclosed in a water and dust tight case to give it the greatest possible protection, and to insure it so far as possible against the influences that might



Speed, Torque and Efficiency Curve of the General Electric Universal Automobile Motor, Rated at 85 Volts, 28 Amperes and 1200 Revolutions a Minute.

cause wear. These housings are of pressed or cast steel and differ somewhat in design. An example of standard construction is the type of automobile vehicle motor made by the General Electric Company which is regular equipment with a number of the best known makes of pleasure cars and wagons and trucks.

It will be noted by reference to an accompanying illustration that the cases of these motors are identical, differing only in proportions. These are known as the universal automobile motor and are produced in eight sizes, the housing being referred to in shop practise as the frame. These frames are steel castings, the bearing head commutator end being integral. Referring to the illustration it will be seen that this end has two lugs which form the hinges on which the aluminum cover plate swings. The frame has four internal lugs at the open end, which take the bolts that retain the end plate, and at the side of the frame just inside the hinged cover plate are two lugs that carry the brush rigging. The first process in working the frame is to machine it inside and out, so that it is practically uniform in thickness and is smooth and finished in appearance. The opening for the hinged cover plate is fitted very accurately by machining, and the cast aluminum cover plate is machined to exactly fit the opening. The end plate is cast iron, ribbed to have lightness and strength, and this is similarly finished by machining.

While the frame is in the hands of the machine tool men it is drilled for the bolt and screw holes. These are seldom varied, save for those for the supporting brackets. In all the shop work fixtures are used, so that each frame is identical, and with any number all the parts ought to be interchangeable. Following the frame through the shop, the cover plate is fitted, and the frame is then ready for the installation of the pole pieces. The universal automobile motor is a four-pole type, and reference to an illustration of the motor will show that the poles are secured to the case by two bolts each. These bolts have countersunk heads in the pole pieces. The pole pieces are oblong in shape and are curved at the top and bottom to conform to the contour of the frame, there being at either side of the top a flange or horn that serves to retain the winding, and also increases the surface area of the pole. The poles are built of a number of sections of soft iron .0625 inch thickness, and secured with two bolts running longitudinally. The poles are not given treatment, the laminations being in contact.

The pole windings are formed to fit closely around the pole pieces, and when the poles are bolted to the frame they are securely retained between the flanges or horns of the poles and the shell. The proportions of these is a matter of design.

The building of the armature is a process that calls for both machine and wire working. The design of the armature is with reference to the work to be done, just as all motors are built for a specific purpose, having different forms of core and windings, and for a definite maximum speed. As has been stated, the number of windings and the number of commutator segments are also matters of design, and the purpose of the engineer is to make the commutator as small as is practicable and the windings as many as is consistent taking into consideration the proportions of the commutator.

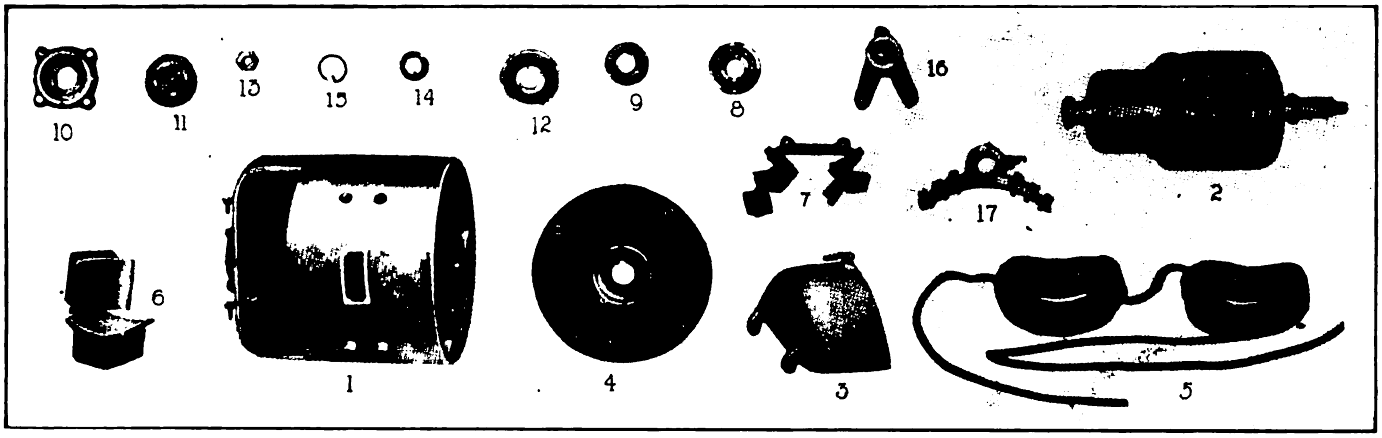
The proportions of the armature used in the universal automobile motor are shown in the accompanying illustrations. The armature shaft is made of a high grade steel, heat treated and very carefully machined, which has a keyway in it. As an illustration of the care in construction it should be stated that each individual bearing is fitted to the shaft, this insuring absolute fit and certainty of operation. On this shaft is fitted the armature core. The armature core is built on what is known as a "quill," this being a

steel sleeve with a collar at the commutator end. The core is composed of a large number of sheets of soft iron approximately .01 inch thickness. These sheets are japanned on either side, this japan serving as insulation. The sheets have cut into the peripheries a number of rectangular channels which might be likened to teeth. These are about twice as deep as they are wide, and as a sheet is seen the bottoms of the channels are closer together than are the tops or openings.

As these sheets are cut at the centre to the exact size of the "quill" when the core is being assembled, the required number is placed on the quill, there being a collar or plate that fits against the collar of the sleeve. The core is placed in a hydraulic press and the sheets are forced together under heavy pressure until they practically form a solid mass. Then an end plate or collar is forced on the sleeve and secured with a lock washer. The core then has a series of rectangular channels extending around its periphery. It may be well to interpolate here that the laminated core is intended to have the greatest permeability and a very

The wire is formed for the winding by bending it about a core, and when shaped it may be said to have two coils at one end and both sides, with the ends of the wire projecting beyond the end that has but one coil. Where the wire is in two coils there is additional insulation about the winding. The ends of the wires are tinned to insure full contact when soldered.

There are two windings in each of the channels of the armature core, the first of which is laid in and the free ends of the wire are soldered into the slots in the armature segments. The windings are so shaped that the sides of each are fitted into two of the core channels, and so the windings are placed in exact relation around the circumference of the armature. After the first winding is laid the ends are soldered to the commutator segments, and insulation is placed above the exposed ends of the wires at the junctures with the segments. Then the second winding is installed. This is done as was the first winding, and then the armature is wound in several places with strong cord to retain the windings. Thus each channel or groove of the armature core is filled with wiring, there being really



The Elements of an Electric Vehicle Motor: 1, Frame or Shell; 2, Armature; 3, Door or Cover; 4, End Bearing Plate; 5, Field Pieces; 6, Field Coils; 7, Brush Holder Yoke, Brush Holder and Brushes; 8, Pinion End Bearing; 9, Commutator End Bearing; 10, Commutator End Bearing Retainer; 11, Motor End Cap; 12, Pinion End Bearing Retainer; 13, Armature Shaft Nut; 14, Motor Bearing Lock Nut; 15, Spring Wire Lock Nut; 16, Radius Rod Socket; 17, Motor Support Bracket.

low resistance, and the greater the number of channels for windings the less is the influence of the eddy currents.

The commutator is composed of a series of segments of wedge shaped copper bar. One end of each segment has a lug or arm at right angles to the section, and the end of this arm and segment is slotted. The segments are mounted in a core of insulating material and between each segment is a sheet of mica. In the making of the commutators great care is taken to have the segments in exact relation, so far as space between them is concerned, and the insulation is very carefully prepared. The commutator is built separately and is assembled with the core when the armature is ready for the winding.

The winding of the armature is really an installation of windings that have been made ready. The windings are of square or rectangular copper wire, there being a stated number in each group. Each group is covered with a heavy cotton tape wound about it, and each of these makes a single winding.

four layers, two of each loop. The ends of the second series of loops are soldered to the commutator segments, and the solder is trimmed and the commutator is made smooth and clean. The core is then wound with wire under considerable tension in several places, and the wire is soldered and the coils are sweated together with solder. This retains the windings firmly in the core.

The core is dipped into an insulating compound that penetrates the cotton covering of the wires and permeates it thoroughly, and after the dipping the core is allowed to drain and dry for six hours. Then it is placed in an oven and baked for 20 hours. This solidifies the insulating compound that is expected to fill every void in the cotton, and makes the windings in the channels practically solid with insulation thoroughly protecting the wires. The purpose is to insulate the windings from the core, and to have perfect circuits through each series of wires from one commutator segment to another.

Extreme care is taken that each armature shall bal-

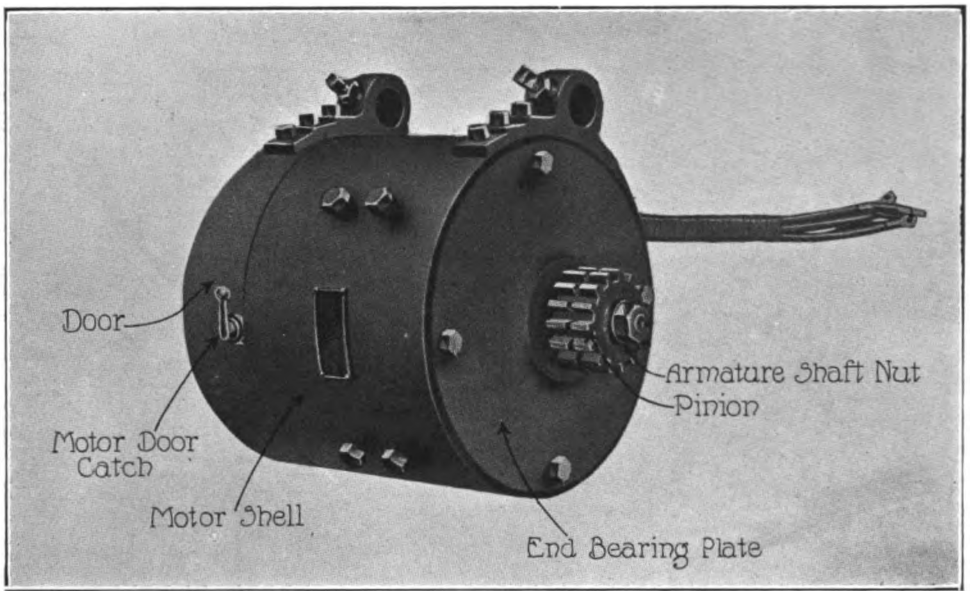
ance. The shaft or spindle is keyed to the quill or sleeve by a keyway that extends through the quill, and it is possible to remove the shaft at any time that this may be necessary. The balancing is accomplished by adding weight to the plate retaining the core laminae, or by drilling it. The next process is to cut out the mica strips between the segments of the commutator to the depth of .0625 inch. This is done by a cutter that revolves on a vertical shaft, and the armature is clamped in a carrier so that the commutator is advanced with the mica insulation between each segment against the cutter. This is practically the final work on the armature aside from polishing the commutator.

It may be well to say a word about the process of insulating the armature by dipping it in a compound and baking it to thoroughly dry the insulation. There are two purposes in the mind of the engineer. The one is to insulate it to secure high electric efficiency, and the other is to protect the wiring against the influences of moisture. The insulating follows this practise throughout the building of all motors, but where a motor is to be used in a country that is excessively humid or wet even greater care is taken, and in some instances the time taken to insulate the armature by dipping in a compound and baking is 100 hours.

The armature as it is completed is an exceedingly substantial and enduring construction, and it is held from an engineering standpoint that it ought to endure for many years, for there is nothing to wear aside from the commutator, which contacts with fiber graphite brushes, and these are in a sense self-lubricating. There is also a lubricating quality to the copper segments, and theoretically a commutator should wear almost imperceptibly in a number of years' service.

The windings of the pole pieces are subjected to the same method of insulating as are the armature windings, but these are treated by a vacuum process, so that the compound is forced into every void of the cotton covering of the wire, and this insures against every possibility of leakage. When the insulation has been baked the pole windings are practically solid, the wire being held by the compound that has permeated the cotton fabric between the coils.

The pole pieces and the windings are bolted to the motor frame, and in the assembling the armature shaft or spindle is mounted on two annular ball bearings, that at the commutator end being mounted in what is known as a retainer, which is covered by a cap. The bearing at the pinion end of the shaft is supported by the motor end bearing plate, being carried by a collar that is known as a retainer. This retainer is bolted to the end plate. The bearings are firmly fixed on the shafts by retaining nuts, and the bearing caps protect the bearings and serve to retain the lubricant. When the motors are assembled the bearings are packed with refined vaseline, which lubrication ought to serve for a period of approximately six months.



The General Electric Company's Universal Automobile Motor, Fitted with Supporting Brackets and with Sprocket for Morse Silent Chain, as Installed by the General Vehicle Company.

The brush rigging consists of a brush holder yoke, which is bolted to two lugs inside the motor frame, and this supports the brush holders. The brushes are rectangular, with flat ends that contact uniformly with the surface of the commutator, there being a spring pressure of 3.5 pounds a square inch of brush contact surface. The lugs are drilled so that the brush holder yoke may be set about .125 inch from the surface of the commutator, and there are two positions possible, so the motor may be operated either clockwise or counter-clockwise by giving the brushes the shift to the other possible position. As the motor frame is machined it is drilled for the necessary support brackets and for the installation of a radius rod, for it is important that the relation of the motor with reference to the method of power transmission be maintained. The supporting and radius rod brackets are not included in the motor equipment.

In the construction throughout the greatest care is taken to insure perfect work and to have substantial and enduring insulation. Every test that is practical is made during the progress of the work, and after the motor is assembled it is tested by driving it for 45 minutes as a generator and driving it a similar period as a motor. In these tests very careful observation is made, and it is maintained from long experience that if there is any fault or defect in a machine it will be developed. If any condition is noted that needs attention it is remedied and the motor is not approved unless it is up to the standard of the shop.

It is not necessary to specify what conditions

might be developed by the tests, for these are of no importance to the purchaser, either as a manufacturer or user of vehicles, but it may be said that where defects eventuate in motors in service these are the result from conditions that were not manifested in the very exacting testing work.

The facilities for work turned out by the manufacturers of standard motors are of the highest class. The machine tools are the best that can be purchased and the men who handle them work very close, multiplying gauges being necessary where the limit may be .001 inch. The windings are made with great exactness, being formed on cores and the cotton being reinforced with sheet mica or varnished fabric wherever it is believed necessary. All the leads from the coils have carefully soldered terminal connections, and the cable is large and heavily insulated. In the windings rectangular wire is used with the view of getting all the copper into an armature and coils that is possible.

(To Be Continued.)

CENTRAL STATION PROMOTION.

Salesroom Displays of Vehicles and Reduction of Current Rates Suggested.

The subject of central station co-operation and promotion was discussed by W. C. Anderson, president of the Anderson Electric Car Company, Detroit, Mich., at a banquet of the Chicago section of the Electric Vehicle Association of America, and he urged that the Commonwealth Edison Company of Chicago co-operate with the electric vehicle manufacturers and salesmen to bring about the more general use of machines. Mr. Anderson contrasted the endeavors to stimulate the demand for electric household appliances and those directed toward the encouragement of the use of cars and wagons. He suggested that a section of the splendid new showrooms of the company be given over to the display of an electric housed in a structure suitable for a private garage.

Mr. Anderson made a plea for more charging stations and a lower current rate in Chicago, which he pointed out would give the character of service desired and would impel the use of machines. He maintained that while the utilization of the electric vehicle was increasing at a surprising rate, there was no reason to doubt that the industry would benefit in ratio to the opportunities and reasons the public had for using them. Chicago should be the greatest electric vehicle city in the world, Mr. Anderson stated, because of its physical conditions, and assuming that there were 5000 pleasure cars and 5000 service wagons in use there, instead of 3000 pleasure cars and 600 wagons, the revenue from power alone for the Commonwealth Edison Company would be approximately $1,685,000 a year. This estimate was based on an income of $8 a month from pleasure machines and $20 a month for service wagons. No other department of the business offered such desirable possibilities. Mr. Anderson held that the co-operation suggested would increase the use of electric vehicles in Chicago 100 per cent. in two years.

ROAD MAPS FOR ELECTRICS.

New York Electric Vehicle Association Lists Charging Stations in Large Section.

The New York Electric Vehicle Association has published a handbook, which may be obtained at request made to the secretary of the association at 124 West Forty-second street, New York City, which is extremely valuable, and should be copied by other organizations engaged in promoting the use of electrics, both passenger and freight vehicles. The book gives a list of all the charging stations in New York City and Brooklyn, and then alphabetically lists the stations south to Philadelphia, west to Easton, Penn.; north to Hudson, N. Y., and Pittsfield, Mass., and east to New Haven, Conn., as well as a large number of intermediate points. Accompanying this is a map which shows the location of 65 charging stations outside of New York, and it is entirely practical with this to lay out routes for both pleasure and for delivery or haulage anywhere within the area referred to with a certain knowledge of always having current available. Examination of the map gives one a very comprehensive idea of the possibilities for the use of electric machines within a territory that extends from Atlantic City to the south end of the Taconic range of mountains in northwestern Massachusetts, and from New Haven to the Delaware river, as well as a considerable part of the western half of Long Island.

The list designates the charging capacity of each station, and whether or not garaging conveniences may be obtained, the stations being grouped as those with charging facilities of 50 amperes or more, or less than 50 amperes, and those which have not been definitely reported. In addition the book gives distances in different sections of New York City, and summarizes the attention that should be generally given to lead and nickel-iron batteries, and the specific care that each should receive. The lists, maps and other information were prepared by the automobile bureau of the New York Edison Company.

The agency for Atlantic electric wagons and trucks in Montreal, Canada, has been established with A. Jennings & Co., Wellington and Grey Nun streets, in that city, by the Atlantic Vehicle Company. Electric service wagons have been used in Montreal for about two years and while not at first regarded with favor the very low cost of upkeep and maintenance of the machines in use has directed the attention of business men to their economy and reliability, and there seems to be a promising market in Montreal and vicinity.

The possibilities of the electric vehicle have not been appreciated in many of the European nations, and at the showing of motor cars and wagons at Prague, Austria, not a machine of this type was displayed.

NEW CHASSIS CONSTRUCTION DETAILS.

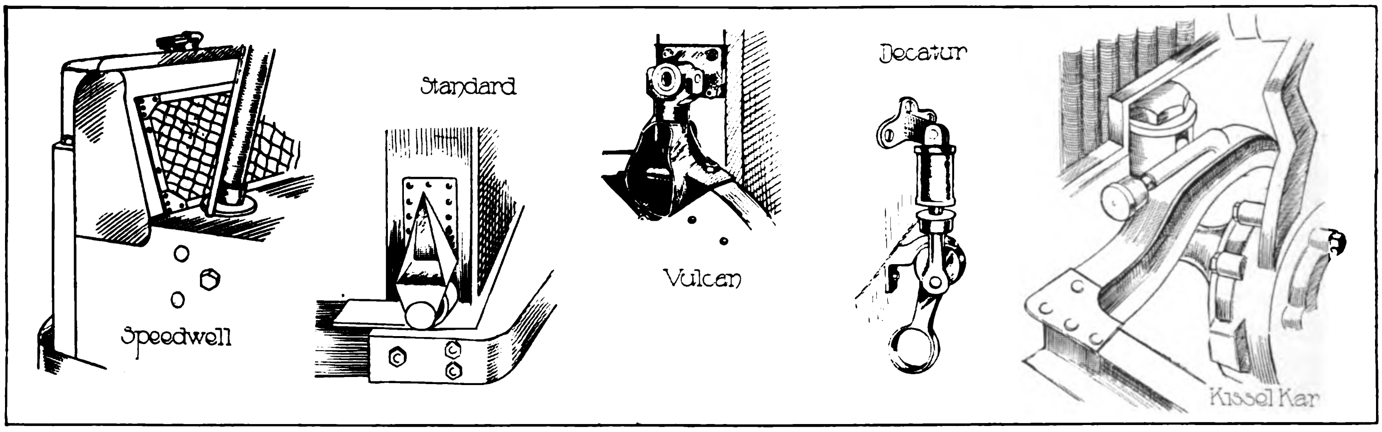
Spring Supported Motor of the Kissel 2500-Pound Wagon---Means for Increasing Strength, Endurance and Efficiency and Eliminating Destructive Influences of Operation.

IN THE improvement of an existing construction the chief purpose of the engineer is to bring about the result desired with the least possible change in the design as a whole, and generally this problem requires much more study and attention than is believed by those who have not actual knowledge. As a manufacturing proposition it is desirable to have work uniform throughout wherever this is practical, and usually this means that the designing has been with a view to production in considerable volume. In shops having large outputs machine tools with jigs or fixtures are always used, and there must be patterns for casting, dies for drop forging, and other special equipment that is costly. Wherever changes are made it is always desirable to utilize as much as is practical of the tools and fixtures, and the question of economizing the expense of changing is often extremely important.

What may appear to be an extremely simple matter when viewed by the casual observer, may be exceedingly complicated when production is considered. A trifling change may represent an expenditure of a considerable amount, and when a number of improvements have been made it will be understood that refinement is only accomplished at material expense and patient observation. For this reason a number of features may be found in a new design that may not be found in any of the productions of the same maker, no matter how carefully the others may have been developed. There are no doubt good reasons for the features of any construction, and occasionally a wide variance is made from generally accepted practise.

An illustration of this may be seen in the 2500-pound KisselKar delivery wagon, in the manner in which the power plant is carried. The purpose of practically every designer has been to protect the motor against the effects of chassis distortion, and this has brought about differing installation. The engine may be carried by the main chassis frame or a sub-frame, and it may be supported by front and rear cross arms or flanges at the front and rear of the case. Ordinarily the chassis frame is the support, but the sub-frame, while it is less susceptible to the stresses of a distorted chassis, is held to add weight and to increase the number of parts. In several instances the motor is carried by a yoke and trunnion at the forward end with the supporting arms at the rear, and in one design the motor is mounted with a ball and socket support at the centre of the front cross frame member and mounted at the rear on lugs carried on guides on which it has a longitudinal movement. In another design there is a sub-frame that is mounted as is the motor just referred to. The endeavor to minimize the vibratory effect on the power plant has resulted in two designers placing the motors on springs. Both of these machines are five tons capacity and naturally subjected to excessive road shocks and the engines have been protected so far as this may be done by the use of leaf springs.

In the design of the 2500-pound KisselKar wagon the engine is carried in a sub-frame, the forward member of which is arched. On this is bolted a bracket with a lug in which is drilled an eye. On the forward cross frame member is a bracket with a heavy cylinder slotted vertically. In the centre of this cylinder is a large bolt. The drilled lug of the sub-frame bracket is placed in this cylinder between helical springs, and the bolt serves as a guide and retains the lug, and the weight of the sub-frame and power plant is carried on the helical spring. Any shock is absorbed, the twist or "weave" of the chassis is compensated by the spring, and the frame is practically free from the influences of operation. The frame is similarly supported at either side near the ends of the side members. The vibrations from the engine are absorbed materially, and it is claimed for this construction that there is no possibility of the motor being affected by the character of the roads.



The Grating Dash of the Speedwell Trucks, C-Spring Radiator Mount of the Standard Machine, Ball and Socket Support of the Vulcan Radiator, the Decatur Seat and Pan Latch, and the Spring Suspension of the Kissel Motor.

The Speedwell trucks are built with the motor un-

der the floorboards and the radiator is supported above the chassis front frame cross member. Back of it is the body frame, and this is carried up to the top of the radiator case. Were the front floorboards carried up on this frame it would obstruct the flow of air through practically half the area of the radiator, and would lessen the radiation materially. To prevent this and to insure the full efficiency of the radiator with the body design the space back of the radiator is covered with a grating, which may be removed when desired. This affords the best of air circulation and sufficient protection.

The radiator of the Standard truck is protected against vibratory stresses and chassis distortion strains by a bracket riveted to the case that has a trunnion that is fitted to the eye of a C shaped spring mounted on the chassis frame. The spring has sufficient resiliency to absorb all shocks, and the mounting can be removed very quickly should there be occasion to remove the radiator. While not intended to endure direct pressure upon the radiator the spring would no doubt compensate a considerable shock upon the casing.

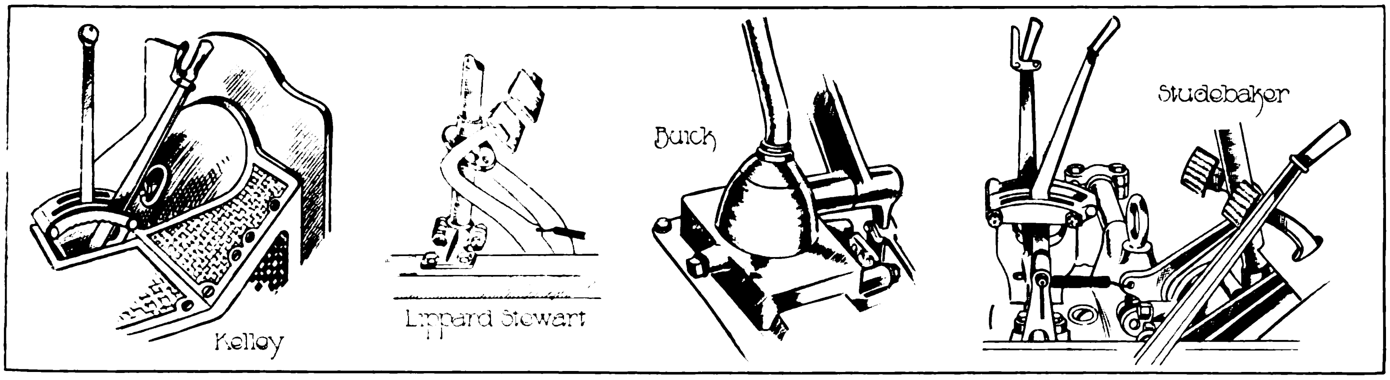
The radiator of the Vulcan trucks is protected against chassis strains by ball and socket supports at either side, the cooler being dropped between the side frame members. This location safeguards it against probable damage from use, and gives a balance that does not bring stresses upon the inlet or outlet manifold connections. The brackets on the chassis frame are large and in these are the sockets in which the globes on the radiator case are carried.

The Decatur wagons are built with a view of having every part very accessible, and the body is constructed so that the seat may be lifted to give access to the mechanism. To secure the seat so that it may not work loose and rattle, and to eliminate any possibility of the seat being thrown by the fastening loosening, a latch is used that has a spring that insures a certain tension after it has been closed. By lifting a lever the latch is opened and the seat may be thrown sidewise so as to expose the engine and transmission.

In the 2000-pound Kelly wagon the radiator is mounted above the rear of the motor, and the footboards are extended forward almost to the engine. It is necessary to have the footboards sharply inclined to the dash to give the needed leg room, and these are cut away directly above the motor. This space is filled by a curved aluminum plate that protects the fan and, being directly ahead of the quadrant of the gearset and emergency brake lever, it is not in any way an inconvenience. The plate is also used in the three-ton Kelly trucks, but it is not as sharply curved. The plates give an unusual appearance to the footboards, but it is not unsightly or objectionable.

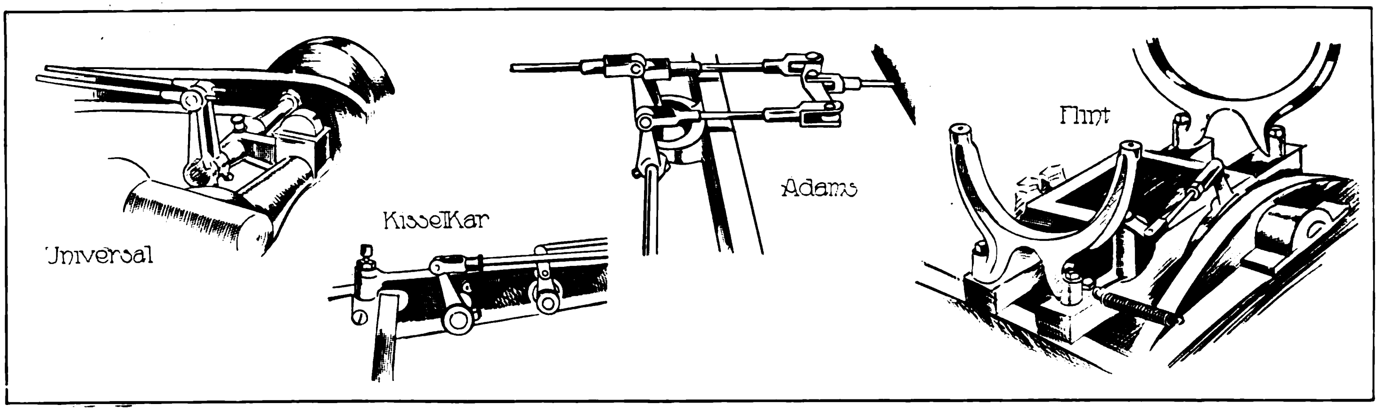
One of the objections to a steering column that is not braced by floorboards is that it will possibly vibrate considerably when a machine is being driven over paving or rough roads, and the effect upon the arms and hands of the driver is benumbing and, in long drivings, even painful. In the Lippard-Stewart delivery wagon construction the steering post is installed close to the left chassis frame side member, and a brace from the frame clamps the post, amply stiffening it. The clamp may be removed in a moment when this is necessary.

In the Buick 1000 and 1500-pound delivery wagons the transmission gearset case is not assembled with the power plant, but it is installed in the rear end of the sub-frame in which the motor is carried. The gear changing lever is mounted on top of the gearset case cover and in a globe socket, so that the changes are made by rocking the lever and moving it as though it were carried in a quadrant of the ordinary type. The emergency brake lever is supported by a shaft at the right. The space between the two levers is more than ordinary, this being necessary for the movement of the gear lever. The appearance of the installation is unusual. The illustration shows the gearset case and levers as seen in the stripped chassis.



Convex Footboard of the Kelly Trucks, the Lippard-Stewart Steering Column Brace, the Buick Globe-Mounted Gear Changing Lever, and the Control Pedals, Levers and Steering Post of the Studebaker Unit Power Plant.

One of the most interesting of power plant designs is that utilized in the Studebaker three-ton truck, which can be regarded as a unit assembly from every point of view. In this the engine, clutch and transmission gearset are combined, and in addition the steering column, the clutch and service brake shafts, as well as the gearset and the first emergency brake levers are included. The assembly is mounted on three points, so that by the removal of the five bolts and the disconnection of the water manifolds and the gasoline supply pipe the whole may be removed as a unit from the chassis frame. In the two forward arms of the motor case are rings, and directly in front of the lever quadrant is a third, so that the sling chains of a



The Brake Shaft Mounting of the One-Ton Universal Wagon, the Brake Shafts of the Kissel 2500-Pound Wagon Carried on the Radius Rod, the Brake Equalizers of the Adams Machines, and the Brackets for the Flint Gasoline Tank.

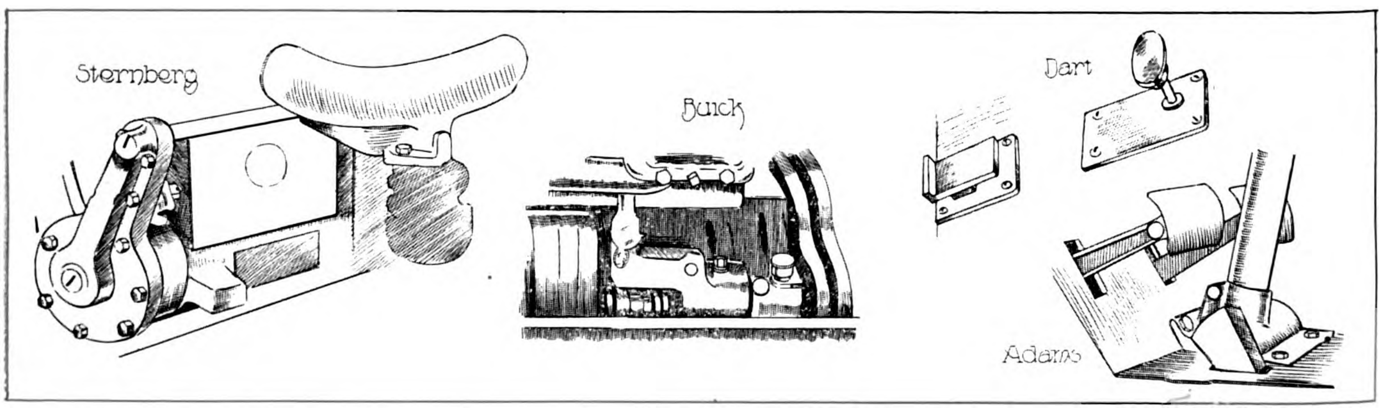
hoist may be hooked into them and the power plant lifted from the frame with the greatest ease. One of the reasons for the design is that with a number of the machines it is possible to have one or more spare motor assemblies, and in the event of need a change can be made very quickly. The first emergency brake operates on the driving shaft with the service brake, and the second lever, which is shown in the sketch, actuates the second emergency brake, which has shoes of the locomotive type that contact with drums on the rear wheels.

The brakes of the Universal one-ton worm driven wagon are the internal expanding type and the shafts are mounted in a bracket on the rear axle housing. The radius rods are very long and are swivelled in the centre of the chassis frame. The chassis centre cross member is wide and in this is an opening which permits free movement of the driving shaft. The brake shaft bracket and the rear end of the radius rod support the brake shafts, as will be seen in the illustration, and at the ends of the sleeve and the shaft are the lever arms, which operate the brake cams. The lever arms are so located that there is a direct pull on the levers, the rods paralleling the driving shaft. The location protects the levers and the rods, and all may be reached very easily in the event of need.

In the KisselKar 2500-pound wagon the brake shafts are mounted on the radius rod, the rear axle end of the rod being carried on a bearing so that it may have a vertical movement. The brakes are internal expanding and external contracting, and as the shaft ends are inside the radius rod they are fully protected, while there is a direct forward pull on the linkage to the forward shafts. This materially simplifies the construction and insures ease of adjustment of the rods should this be necessary.

The brake equalizer of the Adams wagons and trucks is carefully worked out, this being shown in the accompanying illustration. The rod from the shaft of the service brake is carried back along the left side of the chassis frame to an equalizing bar, and is so linked that the bar may have horizontal movement. From either end of the bar is a rod having yoked ends. The rear end of the left rod is connected with the left brake pull rod, and this connection is made at the upper end of a link. The lower end of this link is mounted on the left arm of a yoke carried on a chassis cross frame member. The rear end of the right rod is connected to the lever arm of a shaft, and the left end of this shaft is carried by the right arm of the yoke on the chassis frame. The right end of the shaft is mounted in another bracket on the side member of the chassis frame, and this shaft carries another lever arm to which the right brake pull rod is connected. The yoke ends of the rods are threaded on and the lever arms are clamped on the shafts so that it is possible to make any desired adjustment. No matter what the stress or the chassis distortion there is no possibility of the brake linkage being affected, and an equal pressure will be maintained on the brake, no matter what the condition of operation.

In the Flint delivery wagon the gasoline tank is carried under the driver's seat, and to install it in the



The Governor of the Sternberg Motor, the Governor of the Buick Machine, the Locking and Trip-Releasing Fuel Control of the Dart Motors and the Accelerators of the Adams Wagons.

usual manner on the chassis floorboards would mean the transmission gearset would be exceedingly difficult to reach. Not only this, it is desirable to have the tank so placed that minimized handling is insured, and to protect it against chassis strains is equally important. The designer solved this condition by placing at either side above the supporting arms of the gearset case, on the sub-frame, yokes that are bolted to the arms. The upper sections of these yokes are semi-circular, and into them is bolted a cylinder tank. The tank can be removed by loosening these bolts. It is so elevated above the gearset case that ordinary work can be accomplished without difficulty. Carrying a fuel tank on a sub-frame may appear to be an extreme precaution, but with this installation there is no possibility of strain on the container or the supply line to the carburetor.

The design of the Sternberg motor governor is somewhat out of the ordinary and it is driven from an extension of the camshaft. This governor is housed in a case installed at an angle to give a direct lead of the linkage to the valve in the intake manifold. The front plate of this housing may be removed if desired by loosening a series of cap screws without changing in any way the mechanism of the governor, and adjustment may be made with great accuracy.

The governor of the Buick delivery wagon is installed at the right side of the motor and is attached to the engine case, it having the appearance of a cylinder with the halves offset. In the installation a shaft extends through the lower section, being driven from the timing gears, and the extension of this shaft is coupled to the magneto, which is located directly in the rear. From the rear end of the governor case there is a housing that is connected with the intake manifold of the engine, and this contains the linkage with the valve. The governor is a simple diaphragm piston type and is said to be very efficient and accurate.

One of the interesting details of the Dart wagons is the foot control of the fuel supply. Instead of the usual form of accelerator lever, which is susceptible to the influence of road shock when the foot is resting upon it, the Dart construction has plunger toe and heel pedals. Normally the foot rests on both pedals when driving, and pressing the heel pedal varies the fuel. The pedal may be locked in any position, and a uniform supply of fuel insured, but when a change is desired this may be obtained by releasing the pedal by pressing the toe pedal. The pedals may be used to give the same effect as with the ordinary accelerator by exerting pressure upon both.

The Adams wagons and trucks have a foot accelerator that is also unusual in appearance, and it is located in the floorboards as shown in the accompanying illustration. The accelerator is a block that is pivoted below so as to have a swinging longitudinal movement in a slot, and it may be moved by resting the toe upon it, or it may be maintained in any position desired by placing the foot against it, this giving the required steadiness of throttle.

SALES OPPORTUNITIES ABROAD.

Bureau of Foreign and Domestic Commerce Has Information of Value to Makers.

American builders of motor trucks who will address inquiry to No. 10,998, bureau of foreign and domestic commerce, Department of Commerce, Washington, D. C., can learn the name and address of a consul who has filed with the bureau information that may develop an unusual opportunity for selling. A motor transportation company is now being organized in a foreign city for the haulage of cotton, coal, iron, machinery and heavy merchandise between the docks and the mills, warehouses and stores, and it is purposed to install an equipment of about 25 trucks with capacities from three to 10 tons, and to add to this as the needs are developed. It is desired that some of the chassis be equipped with quick discharging bodies, and some have winches installed for the handling of heavy and bulky freight. There is good reason to believe that many, if not all, of the machines will be purchased in the United States, and pending the completion of the company and the determination of its plans manufacturers can communicate with the consul and place such information as they desire at the disposal of the company.

KNOX PROVES EFFICIENT.

Meriden Concern Finds It Capable to Haul Capacity Loads up Steep Incline.

Meriden, Conn., has more than its share of hills and one of its largest manufacturing plants, that of the Parker Bros. Company, is located at the top of one of the steepest inclines in the city. This necessitates an immense amount of hard trucking on the part of the Parker company, the larger portion of which is now done by a big Knox four-ton truck, made by the Knox Automobile Company, Springfield, Mass.

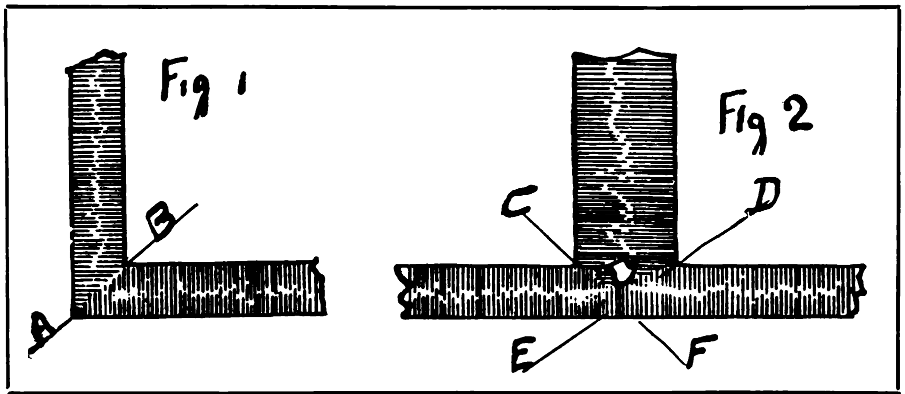
This vehicle has been in service for about 1.5 years and averages three round trips a day to the branch factory in the valley at Yalesville, three miles away, hauling its full capacity load six days a week up the steep grades to the main plant. Occasionally it is called upon to make four round trips to Yalesville and in addition to this frequently runs on special hauls to the freight house or other places between times. The repairman at the Parker garage states that the truck has scarcely seen the inside of the shop since it was first put into operation.

One of the largest sales of motor trucks to a dry goods firm was announced recently by the White Company, Cleveland, O., maker of the White, with which an order was placed by Stern Bros. of New York City for 15 machines. The new fleet will be identical in design to two White trucks which have been in the service of the company for about a year.

ALL-METAL MOTOR TRUCK WHEELS.

Riveted and Welded Types Intended to Secure Minimum Weight and Maximum Endurance and Escape Casting Defects—Carefully Developed Designs Have Overcome Faults of Cast Constructions and Minimized Road Shock Influences.

IN THE experience of the European all-metal motor vehicle wheel makers two types have been produced, the one being the casting and the other built

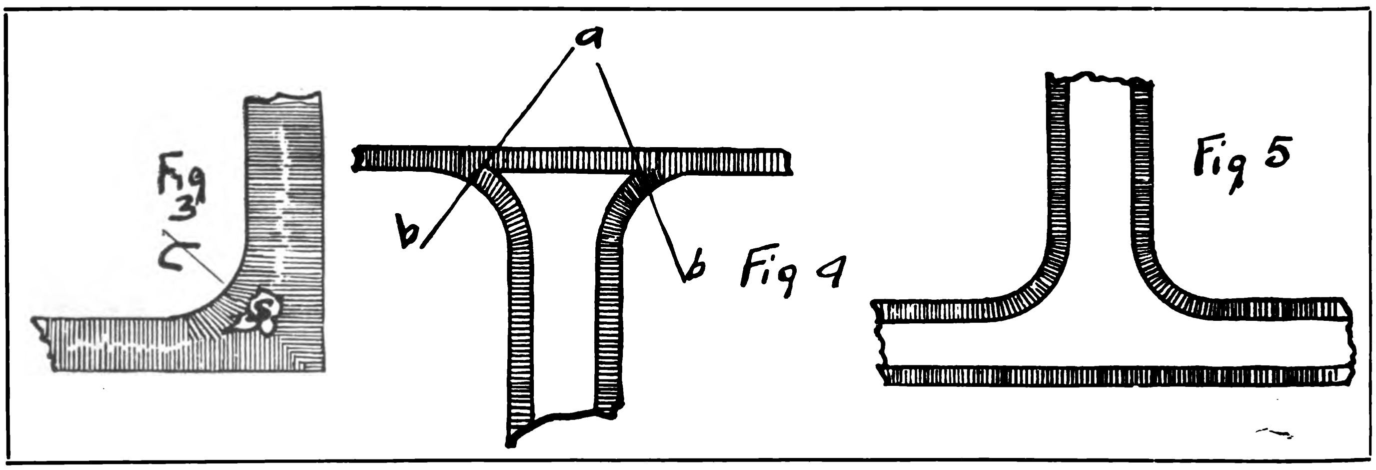


by riveting or welding stampings. The former construction has been more generally adopted than the other for a number of reasons, but it may be said that it appeared to be the cheaper and more logical to cast wheels than to build them, and there has been a very broad general knowledge of casting metals that appeared to justify the belief that such wheels could be made sufficient in every requirement.

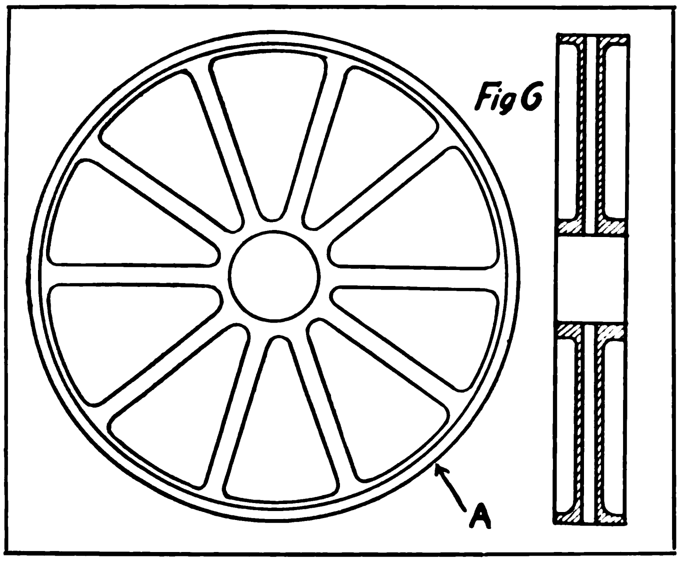
The steel wheel, so far as the design is concerned, does not appear to be a problem of unusual proportions, but it was found that it was extremely difficult to produce what would have every desired quality and be free from faults. Metal casting is an art when it becomes necessary to secure the greatest strength with the minimum of weight, because it is imperative that the material contain the elements that will resist all stresses and strains and endure a long period of service. As is well known to engineers, vibration will eventually bring about a condition of crystallization that is known as fatigue, when the metal loses its strength and becomes so brittle that it will fracture, and generally speaking this result will be realized quicker in a casting than in a forging, for the grain of the latter is finer and the better united.

The softest and most ductile metals will become fatigued, and when a steel has been treated or tempered it will have strength to resist strain and will maintain its form, but it becomes the more susceptible to the influences of vibration. In the casting of steel the metal generally cools in ratio to the proportions of the part cast, and where extreme strength is imperative uniformity of cooling is sometimes promoted by heating or by both, so that there will be a perfectly homogeneous section and there will not be structural strains due to shrinkage as the casting cools. The application of both heat and cooling influence in casting is too expensive to be considered in the production of steel or metal wheels, and with this practically eliminated, the engineer must turn to other means to bring about the strength and structural uniformity that is desired.

English engineers have sought to avoid the difficulties encountered in securing satisfactory steel castings by constructing wheels from stamped sheet steel that was riveted or welded together. The riveted wheel has not been given the serious consideration that might appear desirable from the fact that it must be pressed from sheet steel, generally rolled, and the different parts riveted. Under any circumstances the hub must be a casting, and the other sections, the spokes and the rims, must be drilled and assembled. There is always a possibility of a weakness from the rivet holes or the rivets, and there is a constant strain upon the rivets that might be expected to result in wear. While it is true that rivets could be tightened it is also equally certain that these might not be discovered until a



wheel had failed. This is not meant to imply that these wheels are necessarily weak, but it is maintained that these are not regarded as reliable as others



when considered from every point of view.

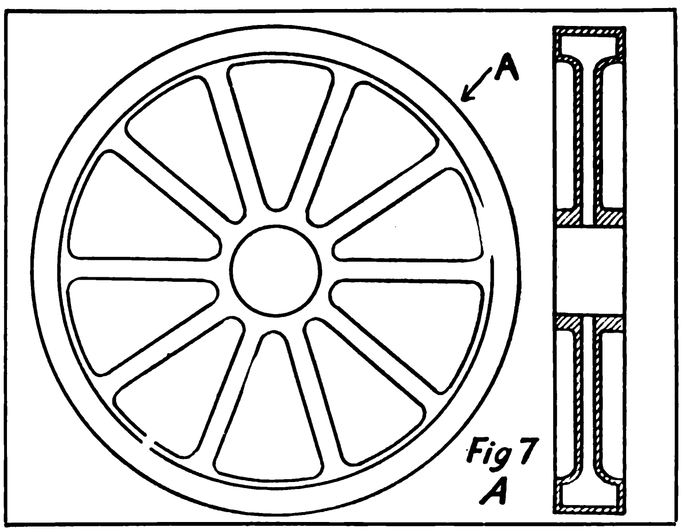
The wheel of stamped steel sections welded by the autogenous process has been built by several makers in England, and these have been found to be light and strong, having sufficient weight of metal in all parts where stress can be expected, and minimum thickness of walls has been compensated by large diameter spokes and generous rim sections. The disc and rim type of wheel, which has been used with a number of heavy machines with considerable success in England and continental Europe, and have been used in America by two builders of electric vehicles, does not appear to have met general approval, although this may be due to the lack of knowledge of the possibilities of this form of construction. The autogenous or electric processes make possible the satisfactory welding of any parts of wheels, and with this there is the strength of the stamped metal, a factor of considerable importance, to be considered. Whether or not built wheels are more costly, and whether they have greater strength and endurance, when contrasted with other types, is not known. In fact, there is very little knowledge of these forms of constructions in America, and the experience of the English builders has not been given publicity.

The European builders have turned to cast steel wheels, and the first of these were solid. One of the conditions that was experienced was the possibility of spokes being weakened from shrinkage cracks near the juncture with the rim, evidently due to quicker cooling, for these were the smallest sections. Where the wheels were in service it was found that fatigue first developed at the small section of the spoke, and this was to a certain extent overcome by webs between the spokes that were longitudinal of the rim. With the different sizes of wheels the conditions were found to vary somewhat, and with the heavy forms the Y spoke was adopted as being the better construction and having the greatest strength. From this was developed the hollow spoke and eventually the hollow rim. The Fischer wheels, made at Schaffhausen, Switzerland, and the Sheffield wheels, made at Sheffield, England, are both of the hollow spoke and hollow rim types, although the Sheffield wheels are made with solid rims as well. In this country the Shelden wheel is cast solid, the Smith wheel is cast with webbing and the Timken wheel is cast, treated to be malleable.

The material in the Fischer wheel is steel heated in an electric furnace, and the heat is regulated very accurately by a pyrometer so that the working can be observed and a condition maintained wherever desirable. The Sheffield wheel metal is also worked with an electric furnace and extreme care is taken to have the metal very pure. It is stated that a long period of experimentation was necessary to produce the quality of metal that would endure satisfactorily.

There is no question that steel wheels have within a comparatively short time attracted much attention in America, but especially from the automobile engineer. The people, however, have not had sufficient knowledge of them or their qualities to judge intelligently, and it is probable that it will be necessary for comparative service for a considerable length of time before the all-metal wheels will be generally known by their merits. Briefly, it is claimed for the metal wheel that as compared with wood it has superior strength, is lighter, that it can be made to a uniform size and there will be no variance so far as tire installation is concerned, and that it is certain to be true when made.

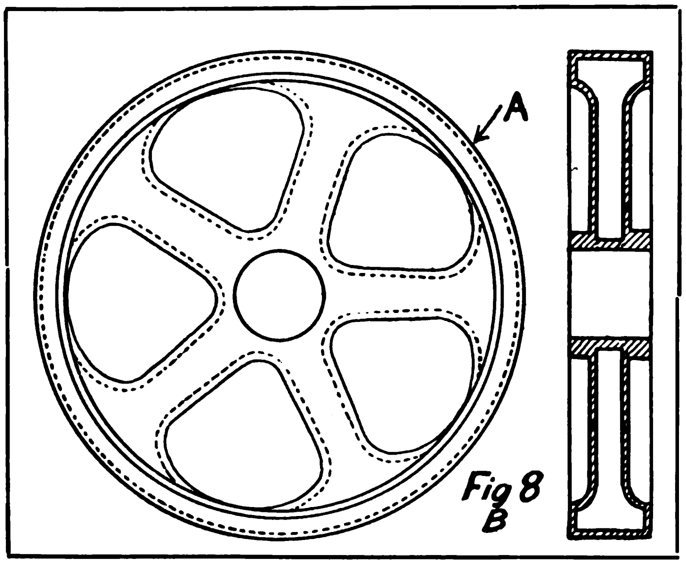
The disadvantages or possible fault in all metal wheels that have been thus far developed are excessive weight, development of cracks and non-resiliency. But it is maintained that these are covered entirely by the question of design in the cast steel wheel. It is claimed, however, that the same agencies that are developing trucks are also developing the steel wheel, and there cannot be otherwise than an improvement. The weight of the wheels is receiving an attention that



will result in construction that will have, in all probability, standards for differing designs. Designers and foundrymen are now endeavoring to obtain thinner

sections, and a wheel with a quarter-inch wall thickness is not at all uncommon.

It may be well to here point out that the require-



ments of the automobile industry have developed special metals and alloys because of the need of great strength with minimum weight, and with the perfection of these materials the results have been manifold. The possibilities have encouraged the use of such metals, the production has been increased and the prices decreased in ratio of production, the vehicles have given longer and better service, and the industry has been directly benefited. Probably the decrease of prices with increase of production has been the greatest factor in promoting the use of special metals, for in small quantities the cost was relatively large.

In the making of the all-metal wheel there is quite as much need of extreme strength and light weight as in any other form of construction, but while with the built type it is possible to have the qualities of the rolled or forged metal, that is, the finer grain, the casting must necessarily have the coarser and really weaker grain. The rolled or forged metal can be heat treated or tempered, but the only treatment practical with the casting is annealing, which will increase its ductility and cause a finer grain, but there will be reduced resiliency and less resistance to the influence of shock. That is, there will not be the property of maintaining conformation.

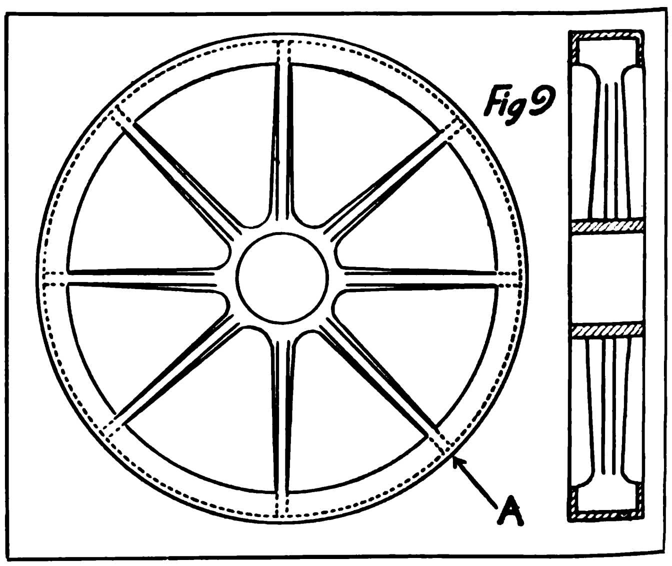
It would be possible to improve the metal from which castings can be made by the use of vanadium, titanium or nickel, which are given in the order of value, and wheels made from steels containing these elements would be decidedly stronger. The real purpose of combining one of these elements with steel is to purify it.

From the viewpoint of the foundryman, whose knowledge of metals and their characteristics is broad, the most serious problem to be considered is the development of cracks in the castings. These appear not only at the foundry, but also in service on the road. The cause can be in the metal as well as in the design, but the purpose of this review will be the better served by ignoring the metal for the time being and leaving this with specifications and dealing with design only, as the crux of the entire proposition is the design.

All iron, steel or ingot castings are composed of crystals that run as regularly in the metal as do the fibers in wood, and as the weakest points in wood are where the branches diverge from the trunk or main stem, so are the weakest points in steel or iron at the points of intersection. The crystals form regularly and at right angles with the contour of the casting at all times. This is illustrated at Fig. 1, where in a casting in the shape of an angle the crystals are formed at right angles from each side of this casting. As shown in this sketch the crystal formations meet at A-B and cause the line of weakness.

Passing to Fig. 2 a glance will show that the lines of weakness are at C-F, E-D or C-D. The crystals run regularly all the way along the straight line of the casting, but the formation of the crystals is changed on the side where there is an intersection. To overcome this irregularity of crystal formation at intersections, heavy fillets have been resorted to, but not with gratifying results. In such construction, though the crystals are formed more regularly, the amount of metal in a fillet addition, together with that caused by the lug or arm, may result in shrink holes, and the grain will appear coarser at that point. These shrink holes, as seen in Fig. 3, are very irregular in form and size, so it is apparent that fillets are a doubtful remedy, and serve the purpose but very little. But where such shrink holes may be created a core might be used to excellent advantage.

Turning to Fig. 4, in which the designs shown at Figs. 2 and 3 are combined, the core is used, and in this the change of crystal formation, and, consequently, the lines of weakness are at A-B. The crystals are regular at either side of the core and on the solid side of the casting that intersects the walls formed by the core, but the change is apparent where the walls and



the side join. At Fig. 5 is shown the ideal design without junctures or joints of any kind, such as are seen at A-B in Fig. 4. In this design the crystals are

formed regularly along the walls of the casting.

Having considered the questions of weight and lines of weakness, the vital problem of resiliency is met with. Resilience is the power of metal to assume its original shape and size after distortion by the application of force. A solid iron or steel is not resilient in the sense in which resiliency is applied, for as a mass it does not receive an impression, nor can its shape be distorted by shocks. From the viewpoint of the foundryman wrought or malleable iron is not resilient, though it may take impacts, but that only at the precise point at which the impact occurs, and but slightly return to its original shape when the forces are released. It will take a set comparatively easily, and its support will receive almost the full force of the shock.

To illustrate this point, a wrought or malleable iron ring may be struck a 50-pound blow. It will bend in the direction of the blow and the hand holding it in position does not feel the stinging pain that would be felt were the ring of a fairly high carbon steel. The steel ring, when struck, absorbs or takes up the blow and vibrates to such an extent as to cause it to bounce on its support, while with the wrought or malleable iron ring the blow is transmitted to the support. Because of the low elastic limit of malleable or wrought iron, the severe repeated shocks easily go beyond that limit, causing coarse grain and eventually fracture. A resilient wheel is less likely to develop cracks, as shocks are instantly transmitted over the whole wheel, and thus lose their force at the point of contact.

Elasticity or resiliency is very important and must receive the most careful consideration in truck wheel construction. The elastic limit in steel is dependent upon the carbon contents. It is obvious that the wheels having resilient qualities are best adapted for automobile trucks. Road shocks and impacts cannot be eliminated. They must be taken care of so as to do the least possible harm. In a wheel that is not resilient, the energy as represented by a road shock is transmitted direct to the axle, minus that which is expended in overcoming inertia or motion.

Materials having a low elastic limit are not regarded by the metallurgist or foundryman as suited for motor truck wheels any more than malleable or wrought iron is suitable for springs.

While the material of a truck wheel is very important, the design is an equally potent factor. At Fig. 6 is represented a design that will hardly serve the purpose of a truck wheel. The hollow spokes join the rim at almost a right angle, and no effort is made to eliminate the lines of weakness that are illustrated at Fig. 1 and Fig. 2. Furthermore, the overhang is twice that of the width of the rim and shocks are transmitted to only one or two spokes because of the flat shape of the rim. This wheel would develop weakness and would eventually fracture in the spoke near the rim. At Fig. 7 a hollow spoke joins a hollow rim, but in this there is no endeavor made to overcome the weakness at the joint of the spoke and the rim. But the hollow rim makes possible the distribution of the shocks somewhat over the whole rim, rather than just between two spokes. However, with this design the weakness and the eventual fracture will be at the precise point stated with reference to the design shown in Fig. 6.

In Fig. 9 is shown a wheel that has a channel section rim and an uneven cross section spoke running the full width of the rim. In this the overhang is reduced to a minimum. This rim is resilient and will not bend because of the flanges, but a blow upon a spoke is transmitted to a very large extent directly to the axle.

The channel section rim is a very important part in wheel design. A shock or blow on the rim between the spokes is immediately transmitted to the flanges and these vibrate almost independently of the wheel itself. Thus the shock energy is dissipated as it were like the vibrations at the end of a tuning fork. At Fig. 8 (hollow rim) the rim is too stiff and will not vibrate sufficiently, so that the shocks are transmitted directly to the axle. The wheel is also heavier than one of channel section.

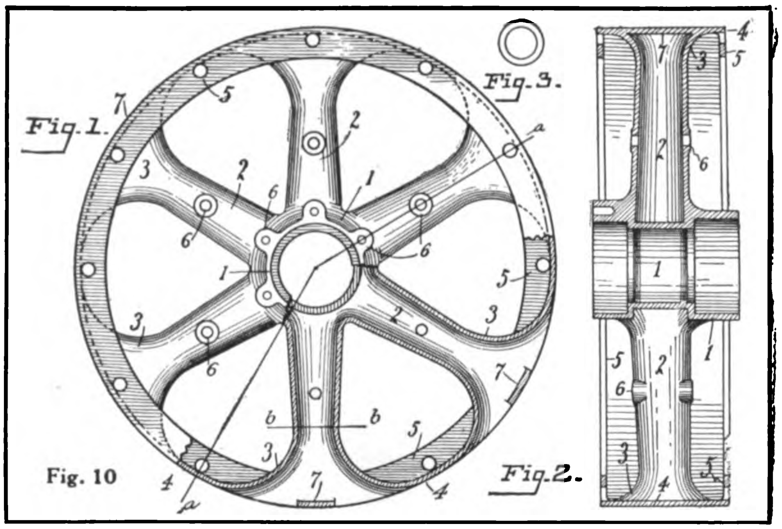


Fig. 10

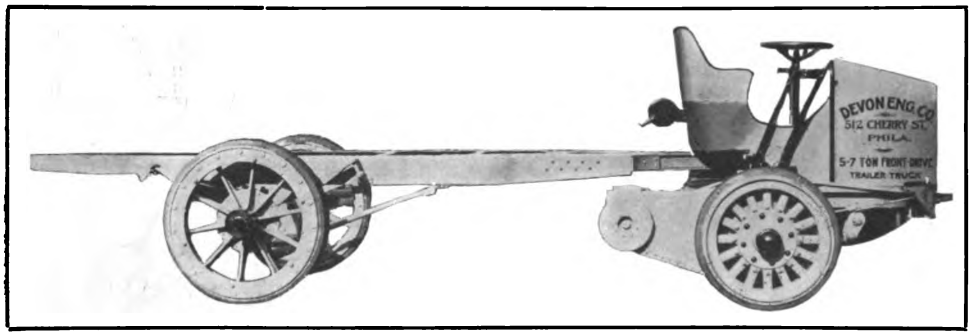
In the perfectly designed and balanced wheel shocks should not be taken up by the rim alone, but they should be distributed over the whole wheel, that is, it should vibrate, making the wheel less liable to develop cracks. In the wheel shown in Fig. 10 these fundamental qualities are embodied in the design. In this all the joints between the rim and spokes are eliminated, and with them the conditions that make for weakness in steel castings. Instead of joining the spokes to the rim of the wheel, the spokes and rim are one continuous integral part, light and of even thickness. Shocks and impacts are no more sustained by the rim alone, but are evenly distributed to both rim and spokes. There are no obstructions to the course of vibration. Were one to strike a blow at A in Fig. 10 and the vibrations are instantly transmitted to the spoke, from there again to rim, and so on. But if this spoke were at a right angle as in Fig. 6 or Fig. 9 and a blow given on either rim at A, the vibrations would

stop at the spoke. The spokes cannot swing with the rim, as it were. The rim would vibrate in one direction, and the spokes in another. The design of this wheel is most ideal, and its weight is somewhat less than that of a wood wheel of the same carrying capacity. These wheels can be made to the S. A. E. standards and will take any type of S. A. E. flange-attached tire.

DEVON FRONT-DRIVE TRACTOR.

Chassis Designed for Use with Special Equipment or Converted Animal Wagons.

The Devon Engineering Company, Philadelphia, Penn., is building a power equipment that may be used with special body construction, or with converted animal wagons, the machine being a chassis containing a power plant that is mounted on two wheels to which the power is transmitted. The chassis is constructed as a unit and to this a frame, rear axle, wheels and body may be coupled, the proportions of the body and capacity depending very largely upon the requirements of the purchaser and the varying conditions under which his particular work must be performed.



The Front Wheel Driven Devon Chassis, Adapted for Regular Equipment or for the Use of Converted Horse Vehicles.

The power plant is conventional, being a four-cylinder water-cooled, four-cycle gasoline motor, carried under a hood, and this is mounted in the frame, which also carries the radiator, gasoline tank and the usual auxiliaries. The chassis is steered by a large hand wheel, the attached gear and body being pivoted so that the chassis may be turned to any desired degree. The power is applied to the chassis wheels in whatever ratio may be desired. Back of the driver's seat on the chassis is the turntable, to which the body gear is attached, this taking the form of a steel frame attached to a dead axle fitted with steel wheels. The wheels may be shod with steel or rubber tires. On this axle and frame is mounted the body. It is entirely practical for a purchaser to adapt horse wagons to use with the chassis by the use of comparatively inexpensive frames. The chassis is regarded as having sufficient power to haul six tons under all working conditions, and while the speed is low as compared with machines that are sprung and have rubber tires, the capacity is relatively large and the cost of maintenance is small. The greater part of the weight is carried on the dead rear axle and the expense for tires is minimized. With the front-wheel drive it is claimed that skidding is practically negligible.

THE HORSE, TRUCK AND TRACTOR.

An Analysis of the Cost and Productiveness of Types of Highway Vehicles.

"The Horse, Truck and Tractor" is the title of a book issued from the press of F. G. Browne & Co., Chicago, Ill., which was written in collaboration by Herbert N. Casson, R. W. Hutchinson, Jr., and L. W. Ellis. As the title implies, the book is in three parts, the first of which, by Mr. Casson, is devoted to the horse. This article estimates the economic value of animals, shows that the value has been largely and the numbers considerably increased during a comparatively brief period, and that when measured by known standards the horse is a very costly creature. Mr. Hutchinson writes of the experience with and the possibilities for economy with the utilization of trucks. He included in his consideration a considerable number of illustrations of efficiency and estimates of operation costs for differing services. Mr. Ellis has intimate knowledge of the production and use of farming power machinery, and he deals with tractors, the actual value and the practical economy of road trains being set forth with much care. This is the first work that considers highway transportation with reference to all three practical forms of haulage. It has merit in that it demonstrates very graphically the enormous price paid for handling and freight carrying by the nation, and suggests the material saving that could be made with motorized transporting facilities.

The city council of Minneapolis, Minn., has before it an ordinance that, if it is passed, will limit the weight of loads that may be hauled through the streets to 15,000 pounds. This ordinance is intended to apply to all vehicles, and the reason to justify it is the wear of heavy vehicles on the paving. But, strangely enough, the measure does not limit the width of tires, and this is an argument that is made by the owners of trucks against its passage.

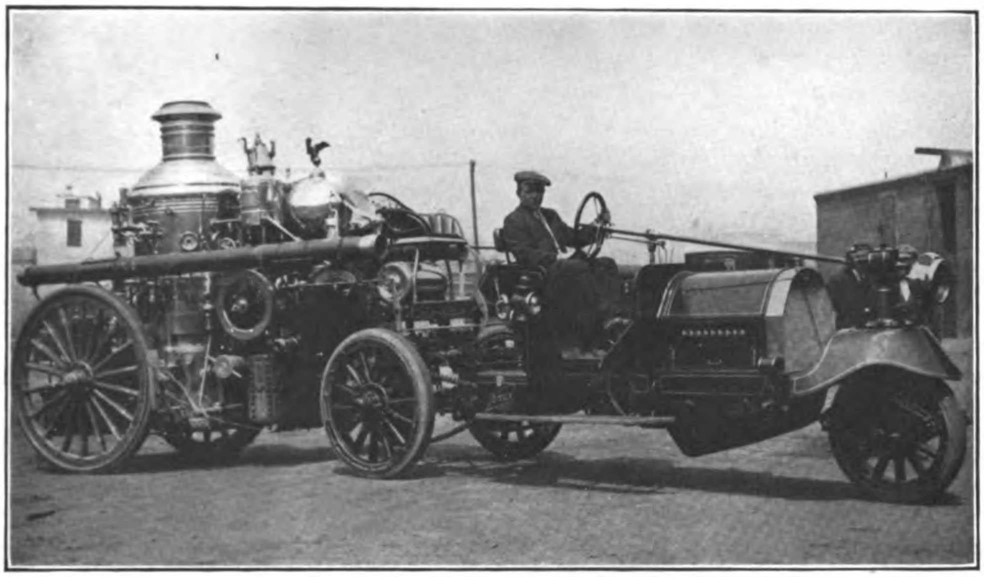
The Blaugas Company of America has begun to manufacture at Long Island City, N. Y., a liquid gas known as blaugas, which has been used for a considerable length of time in Germany and is said to be efficient and economical. The Atlantic Blaugas Company has used this fuel with satisfaction in the operation of its motor vehicles. The fuel is not yet produced in commercial quantities, but it is obtainable by those who care to experiment and determine its value.

VALUE OF KNOX-MARTIN TRACTOR.

People of Tarrytown, N. Y., Quickly Appreciate Its Economy and Efficiency.

An interesting example of the rapid education of the public with respect to the economy and efficiency of motor driven fire apparatus is noted in the experience of the department in Tarrytown, N. Y. About a year ago, after some little discussion, the town voted an appropriation for the purchase of a Knox-Martin tractor, made by the Knox Automobile Company, Springfield, Mass. This year, on a question of appropriating $13,800 for the purchase of additional motor equipment, the favorable vote was practically unanimous.

Not only was the tractor successful in handling a series of bad fires during the past season, thereby convincing the voters of Tarrytown, but the neighboring towns of North Tarrytown, Dobb's Ferry, Nyack and Briar Cliff Manor have appropriated a total of $35,000 for the purchase of similar apparatus. Several municipalities throughout the country are contemplating the installation of this type of vehicle, an accompanying illustration showing one attached to a steam fire engine in Providence, R. I., where it was demonstrated for 10 days with the result that the city council has been asked for an appropriation for its purchase.



Demonstrating Knox-Martin Tractor with Steam Engine in Providence, R. I.

MOTOR VS. HORSE COST.

Interesting Comparative Figures Prepared by Fire Department in Springfield, Mass.

A table prepared by the board of fire commissioners of Springfield, Mass., showing the comparative cost of upkeep between motor and horse drawn apparatus for the year ending March 31, has demonstrated to the satisfaction of the commissioners that the city is saving thousands of dollars annually in the maintenance of the fire department since the introduction of motor driven apparatus. The average cost of maintenance for the seven motor pieces used as a basis of comparison was $161.89, and the average number of alarms answered by each piece was 140, while the average cost of the two-horse drawn pieces of apparatus used as a basis of comparison was $524.18, and the average number of calls answered was 125. The actual figure for each motor wagon would have been lowered considerably if the amount of money spent for the rebuilding of two motor trucks had not been included.

It is of interest to note that, while the cost of maintenance has been lowered since motor driven apparatus has been introduced into the department, the amount of fire loss has been correspondingly lessened. The annual saving resulting from the quick response to alarms, it is estimated, would pay a considerable portion of the cost of maintaining the department.

According to the table the cost of maintaining truck 1 from April 1, 1912, to March 31, 1913, was $280.32, while the number of runs made during the period was 148. Of this amount, however, about $225 was expended for changing the location of the batteries and other improvements. The cost of the other

pieces of motor apparatus was as follows: Truck 10, $65.21; hose 1, $680.71; hose 7, $31.86; hose 8, $37.40; hose 12, $22.17; hose 13, $15.61. With hose 1, an expense of $625 for rebuilding the truck was added. During that period truck 10 made 165 runs; hose 1, 192; hose 7, 216; hose 8, 110; hose 12, 109; hose 13, 63. It is found that if the sum of $845 spent for rebuilding the two pieces, which occurs at intervals of several years, were deducted from the total, the average would be less than $50, which represents the real cost of upkeep. The expense of maintaining truck 8, horse drawn, for the year, was $620.42, and of hose 10, $427.94. Truck 8 made 107 runs and hose 10, 143.

KisselKar Combination at Work as Street Sprinkler.

NEW STREET CLEANING MACHINE.

Combined Flusher and Sprinkler Produced by Kissel Motor Car Company.

Accompanying illustrations present the new patent combination uniform pressure street flusher and sprinkler recently placed in the market by the Kissel Motor Car Company, Hartford, Wis., maker of KisselKar trucks and pleasure cars. The design is such that it is expected to afford a satisfactory means for cleansing city pavements, and the flushing and sprinkling mechanism is controlled by hand levers under the driver's control, and so arranged that it can be changed from one to the other in an instant.

The chassis is that of a regulation KisselKar three-ton truck, fitted with a 1000-gallon galvanized steel tank. Pressure is produced by taking the water by gravity from the bottom of the tank into a two-stage centrifugal pump directly connected to the motor, and it is maintained that this may be from 20 to 60 pounds according to the speed of the engine. The water is then forced into distributing pipes and out through adjustable nozzles for flushing and through two pipes to sprinkling attachments of the vehicle type. It is claimed that the same pressure can be maintained when the tank is partially full as when entirely filled, making it possible to secure the benefit of all the water contained in the tank.

The sprinklers are so arranged that they will sprinkle the full width of a 60-foot street from curb to curb, or they can be closed down to accommodate 20, 30, 40 or 50-foot streets at will. They will sprinkle both sides at once or either side separately, making it possible to operate the machine successfully where the traffic is heavy. One tank of water will sprinkle seven to eight blocks of 50-foot roadway, or will flush a distance of 3.5 blocks.

ADOPT CHRISTIE TRACTOR.

Central Station in Pawtucket Has First Machine of This Type in Rhode Island.

Following its plan to eliminate horses in the fire department as rapidly as possible, Pawtucket, R. I., has installed a 90 horsepower Christie front drive tractor on its hook and ladder truck at the central station, this equipment replacing a three-horse hitch. The installation is presented in an accompanying illustration, and is the first of this character in Rhode Island, although it is understood that another will soon be placed in Woonsocket.

The tractor itself is in all respects the same as those utilized in New York City, which were described in full in MOTOR TRUCK last July, and was designed and installed by Walter Christie, the well known automobile racing driver, who has long been a strong advocate of the front drive principle. The motor is a four-cylinder unit, with bore of 5.5 inches and stroke of seven.

This construction is rigidly bolted to the forward end of the truck, giving a slightly longer wheelbase than when it was utilized with horses, this now being practically 26 feet. Of course the rear wheels are steered by tiller as with the ordinary vehicle of this type, and the driver must govern his turning not only to accommodate the long wheelbase, but some 12 feet of overhang on the ladders. Although Pawtucket is

Indicating Value of KisselKar Flushing Apparatus.

well supplied with what may be regarded as crooked streets and the turning radius afforded on many runs is often very limited, the driver asserts that the combination is handled as easily as with horses.

NOTES FROM VARIOUS CITIES.

KisselKar Ambulance in West—The Kissel Motor Car Company, Hartford, Wis., maker of KisselKar trucks, recently made sales of motor ambulances to the cities of Milwaukee, Wis., and St. Paul, Minn.

Georgia City Adds to Equipment—Atlanta, Ga., is soon to purchase a triple combination pump, hose and chemical motor car, having 700 gallons capacity.

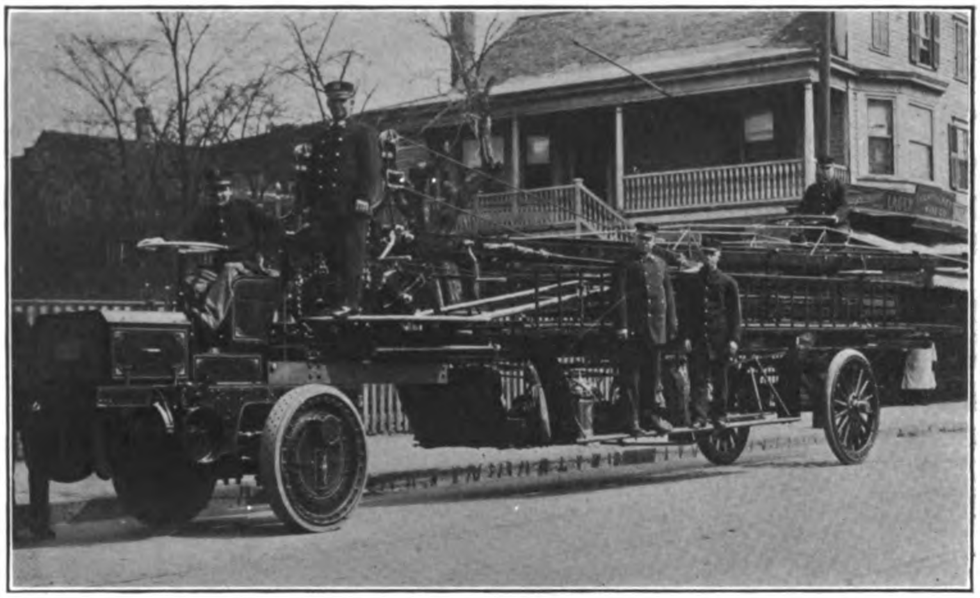
Street Watering Machines at St. Louis—A contracting company that undertook to water the streets of St. Louis, Mo., purchased 10 Smith-Milwaukee trucks, made by the A. O. Smith Company, Milwaukee, Wis., and these machines have performed the work of 50 teams. Two others have been purchased and this year the 12 vehicles will do all the work of watering the streets. Naturally, the number of drivers has been cut down by 38 and this alone is a decided economy, although by no means the most important.

Water Department Purchases Motors—The water board of Hartford, Conn., took a progressive step recently to facilitate the outside business of the department, when it authorized the purchase of motorized equipment. The report favoring the purchase, presented by Commissioner J. H. Root, recommended the purchase of a five-passenger, 50 horsepower touring car; a five-ton truck; a 1.5-ton truck and a .75-ton truck. The machines to be purchased will be Pope-Hartfords, made by the Pope Manufacturing Company of that city.

Akron to Give Big Order—The city of Akron, O., has received sealed bids for three triple combination fire engines, chemical and hose wagons, an 85-foot extension aerial truck, two combintion chemical and hose carts, a supply wagon and three tractors, to cost $65,000.

Des Moines Installs Four Machines—The city council of Des Moines, Ia., has authorized the execution of written contracts for the purchase of new fire apparatus of the motor type. One will be type 14, six-cylinder motor service hook and ladder truck, 105 horsepower, while another will be a tractor of 105 horsepower, six-cylinder, to be attached to the aerial truck. Both of these machines will be purchased of the American-LaFrance Fire Engine Company, Elmira, N. Y. In addition to these the city will purchase two six-cylinder motor driven combination hose and chemical wagons of the Seagrave Company, Columbus, O.

Many Cities Buy White Trucks—High speed chemical and hose trucks are increasing in popularity with the fire chiefs throughout the country and many municipalities are motorizing their equipment as fast as appropriations can be obtained. The large number now in use emphasizes their great value in protective work. Chicago has 11 White six-cylinder 60 horsepower fire patrols, made by the White Company, Cleveland, O., in the service of the insurance underwriters. Recent sales of White trucks were made to the cities of New Castle, Penn.; Dover, N. J.; Easthampton and Malden, Mass.; Sioux City, Ia., and Poughkeepsie and Mount Vernon, N. Y.



Christie Front Drive Tractor Installed with Pawtucket's Hook and Ladder Truck.

Five Cole Cars for Philadelphia—That the gasoline pleasure car is more and more to become a space eliminator for fire department chiefs is shown by the order recently placed by the Philadelphia fire department with the Cole Motor Car Company, Indianapolis, Ind., for five Cole roadsters for the use of battalion chiefs.

Buick in Boston Service—The Buick Boston Company, Boston, Mass., has delivered four 1913 roadsters to the Boston fire department. The machines are equipped with fire fighting equipment and an advantage is obtained in that the local branch of the Buick company is able to supply at a moment's notice any repair parts that may be needed.

GARAGE MEN ORGANIZE.

Owners of Massachusetts Public Service Stations Form New Trade Association.

The Massachusetts Garage Association has been organized for the purpose of generally promoting the interests of the owners of public service stations in that state. The organization as formed is composed chiefly of men doing business in Boston and vicinity, but the intention is to have the membership include every owner or manager of a public garage in the state, provided that the applicant can be recommended by members. The activities of the association will be quite as interesting to owners of wagons and trucks from the fact that a very large number of the machines now in service in Massachusetts are stored, and often maintained, at public stations. One benefit provided for is the exchange of information that would be of value, another is the maintenance of charges for service, another is to insure the public that there will be uniformity of work, and it is purposed to impel the confidence of the people through satisfactory attention. In other words, the fact that a garage is controlled by a member of the association is expected to assure the people of the best of service and reasonable charges for work and supplies.

The officers of the association are: President, J. S. Hathaway, manager of the White Company's garage, Boston; vice president, J. E. Savell, of the Motor Car Service Company's garage, Boston; secretary and treasurer, Chester I. Campbell, 5 Park square, Boston; directors, V. A. Charles, Inter-State Automobile Company, Boston; F. W. Boynton, Hyde Park Auto Station, Hyde Park; John F. Fleming, Brookline; C. E. Harris, Harris Garage Company, Easthampton; J. W. Robertson, Robertson Motor Car Company, Taunton; R. H. Hartley, Church Street Corporation, Lowell; J. E. Savell, Motor Car Service Company, Boston.

BOSTON'S 1914 MOTOR TRUCK SHOW.

Will Take Place from March 17 to 21 Inclusive, and Follow Exhibition of Cars.

The third annual show of motor wagons and trucks of the Boston Commercial Motor Vehicle Association will take place in Mechanics' building, beginning Tuesday, March 17, 1914, and will be concluded the evening of Saturday, March 21. The association at its meeting May 1 decided almost unanimously to hold the exhibition, and it is stated that the expression of the members unable to be present was equally as favorable. While the announcement was made at the show last March that there would be an exposition next year, this was not formally determined until the meeting.

When the pleasure car and service wagon shows were divided in 1912 an interval of three days was arranged between the exhibitions, which was expected to benefit the exhibitors in that it would give them sufficient time to remove the cars and arrange the displays of wagons and trucks, and allow the dealers an interval to take care of business detail that had been neglected during the showing of the pleasure machines. This, however, necessitated a Sunday intervening in the show, and it was found that this required more time than many of the factory representatives could consistently take.

It was believed that the plan as decided on will eliminate at least three days of the time that had been required, and would be much more satisfactory to the exhibitors as a whole, and that there would be a generally larger exhibition. General Manager Chester I. Campbell has already begun preparation for the 1914 show, and he has a considerable number of applications for space. Manager Campbell, in a statement issued by him, predicts that the truck show for the coming year will be the largest and most successful ever held in Boston.

WHITE OMNIBUS SERVICE.

Eight New Passenger Carrying Machines Installed with the Pittsburg Auto Transit Company.

Eight new vehicles with omnibus bodies made by the White Company, Cleveland, O., for the Pittsburg Auto Transit Company, Pittsburg, Penn., were placed in service May 1. The bodies, which strongly resemble street cars, were built by one of the largest street car builders in the country. The design, however, is such that they are held to be much more comfortable in riding.

The machines are of the pay-as-you-enter type and have seats for 34 passengers. They are built with six-cylinder, 60 horsepower motors, giving them an abundance of power for the steep grades in Pittsburg. Passengers will be carried between the downtown business district and the Highland park residential section. The vehicles were prominent in the display at the recent truck show at Motor Square Garden, Pittsburg, where they attracted much attention.

A factory is now being fitted at Yonkers, N. Y., where this year, if the present plans are realized, 40 steam freight carrying trucks will be built for the Bell & Waring Co., of New York. The company is capitalized for $25,000 and it succeeded the American Motor Freight Company. The company is controlled by Harvey W. Bell, Harry G. Waring and Howard C. Phillips. Having worked out extensive experiments with two machines, manufacturing has been decided on. The truck, which will be known as the Bell, will follow closely to accepted design in every respect save the power plant. The engine has several novel features and crude oil will be used for fuel. It is believed that this form of propulsion will be very efficient, and that the low cost of fuel will be a factor of considerable importance in the operation expense.

FOREIGN TRUCK NOTES OF INTEREST

IMPORTANT CONFERENCE PLANNED.

British Government Officials and Commercial Representatives to Discuss Motor Transports.

An imperial conference will be held at London, England, during July for the purpose of dealing with the question of motor transport, including all the industrial uses of motor vehicles. Invitations to attend the conference are being sent out to all parts of the Empire and it is hoped that the government departments of all the colonies interested in the development of road transport will be represented. It is expected that representatives of chambers of commerce, boards of trade, agricultural and planters' societies, municipal and road authorities and important concerns in the engineering and motor trades will be present.

According to present arrangements, it is expected that Prince Arthur of Connaught, who is president of the conference, will receive the delegates July 18, while the following day they will visit the industrial motor vehicle exhibition organized by the Society of Manufacturers & Traders, scheduled to open that date at Olympia. During the course of the conference the delegates will visit garages, depots, etc., where industrial motors are operated in considerable numbers. The following subjects will be discussed at the conference:

The question of fuel supply; present needs and future prospects; the possibility of creating adequate supplies within the Empire.

The consideration of the problems of imperial military motor transport with special reference to the production of types of vehicles, useful both for military work and for industrial work in the dominions and colonies.

The organization of motor transport systems for the carriage of goods, and their value to the mercantile life of the community. The adaptation of existing methods of delivery required to enable traders to take full advantage of the capabilities of mechanically propelled vehicles.

The relations between the British manufacturers and buyers overseas. Desirable arrangements for satisfactory supply, agencies, etc.

Road transport in cities. The carriage of passengers and the municipal uses of motor vehicles. Fire fighting and ambulance services. Postal services.

Rural transport and the uses of the motor to the agriculturist.

THE LACRE POLICE PATROL.

Some Points in Which English Design Differs from Accepted American Practise.

An accompanying illustration presents a motor drive police patrol made by the Lacre Motor Car Company, Ltd., Letchworth, England, which is of particular interest because of the points in which it differs from what has come to be regarded as standard practise with such vehicles in this country. The chassis is that of a regulation 30 horsepower Lacre, on which the company installs its two-ton truck bodies, and it also is utilized for ambulances, mail wagons, etc.

It will be noted that the exterior of the body is without windows. The prisoners are placed in cells along either side of a corridor, extending from the back of the driver's seat to the door at the rear. Ventilation is provided by barred openings near the top of the cells, the roof over the corridor and in the rear door. Two steps lead from the ground to a landing at the rear and on either side of this platform is a seat for an attendant. Other policemen may be accommodated beside the driver or along the running boards at the side.

This type of vehicle not only serves as a patrol wagon in making arrests, but is used as a prison van, the cells being arranged so that it is possible to transfer dangerous criminals or even insane persons without endangering themselves or others. The car illustrated was one of the first supplied to the Glasgow corporation, and is considered satisfactory in every respect.

Lacre Police Patrol in Service in Glasgow, Scotland.

DUTCH MOTOR TRUCK TRIALS.

Twenty-Four Machines Take Part in Automobile Club of Holland's Contest.

The first official commercial motor vehicle trials in Holland, under the auspices of the Automobile Club of Holland, came to an end early last month, although at this writing there are no data available in this country from which to judge of the results. The cars were loaded to rated capacity with bags of sand and the daily mileage was such as to give them tests calculated to demonstrate their availability for cross country work. Incidentally, there was some evidence that the roads and bridges, particularly the latter, were in a condition calling for decided attention if motor

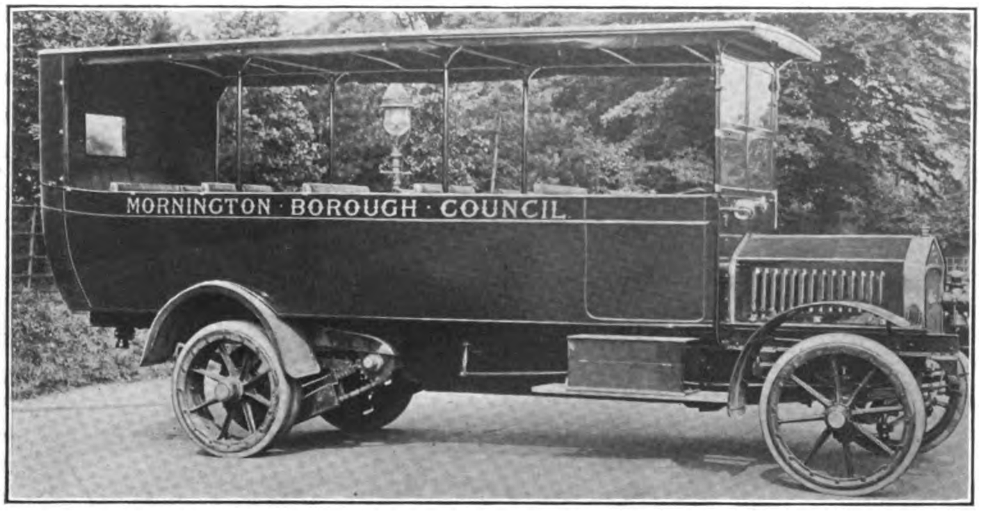
trucks are to be used in general haulage in that country.

The cars taking part were as follows: Mulag, five tons; Bussing, 4.5; Adler, four; Saurer, four; Daimler, four; Bergmann, four; Saurer, four; Lloyd, 3.5; Benz, 3.5; Bussing, 3.5; Delahaye, 3.5; Panhard, 3.5; Mulag, 3.5; Opel, three; three Dietrich, three tons each; N. A. G., three; Benz, 2.5; Thornycroft, 2.25; Saurer, two; Adler, 1.5; Fiat, 1.5; N. A. G., 1.25. Opportunity was had to exhibit the vehicles to prospective purchasers and others interested at several points along the way.

INTEREST IN THE CHAR-A-BANC.

British Concerns Actively Demonstrating This Type of Sight-Seeing Vehicle.

While the type of motor 'bus designated as char-a-banc has proven satisfactory abroad in districts in which it has been found desirable to afford means for passenger transportation where the traffic does not warrant the construction of railroads, it is noticeable that many of the British makers are seeking to develop it along other lines. During the past few months several of these vehicles have been demonstrated in the north of England, Scotland and Wales with a view to interesting local concerns in investing in a proposition calculated to increase their sight-seeing business in the sections most often visited by tourists.



Albion Pay-As-You Enter Type of Char-A-Banc as Designed for New Zealand Service.

An accompanying illustration presents an Albion char-a-banc, made by the Albion Motor Car Company, Ltd., Scotstoun, Glasgow, Scotland, which has been in service in New Zealand for some little time. It will be noted that complete protection is afforded both driver and passengers, the roof and side curtains being arranged so as to provide against all classes of weather conditions. The interior is designed to accommodate 25 passengers and the vehicle is what is termed the pay-as-you-enter type.

The present activity of the manufacturers along this line is based upon the suggestion that with the possession of a car of this character, hotels or inns in the tourist districts are able to offer special inducements in the way of providing attractive means of conveying their guests to points of interest, etc. Particular attention is given to the matter of spring suspension, upholstery and other appointments making for easy riding qualities.

STANDARD LOADING SYSTEMS.

Prominent British Engineer Suggests Importance of Giving Subject Consideration.

It is more or less well known that foreign business men, particularly in Great Britain, apparently have given little consideration to the question of loading and unloading, and until very recently there has been little disposition on the part of the manufacturers to assist them in solving the problem. It is understood, however, that several of those engaged in the business of producing bodies for commercial vehicles have taken up the matter recently, with a view to preparing blue prints and specifications and presenting these to prospective purchasers of chassis in an endeavor to provide that which shall meet the peculiar requirements of the individual installation.

A further indication of the importance attached to this subject at present is found in a recent article in the Commercial Motor, a British print, devoted to the mechanical transport, by Sir John H. A. Macdonald, an English engineer of wide repute. The article also is of interest as suggesting the methods now in vogue in that country. He says in part:

We are naturally a jog-trot nation. Once settled in a groove, we remain in it, and frown on all advice which tells us that our groove is obsolete, and that we suffer loss by complacently staying there. Who does not remember how, for nearly half a century after steam cranes were established on our quays, vast quantities of luggage were carried on men's backs at ports like Dover, Folkestone, Holyhead and Kingstown, from shore to steamer and from steamer to shore, when they could have been picked up in bulk and transferred direct without any difficulty? Either there was no imagination, or imagination was crushed by the spirit of routine. This is but one illustration of such ways of doing the system under which breaking bulk was the rule, transit in bulk from start to finish of journey being the exception. Is it to be the same when the road wagon that conveys goods carries with it the means of moving goods in bulk from wagon to train and from train to wagon? Are goods going by rail still to be put through three loading operations before delivery at their destination? Are they to be delivered to the railway by being put down piecemeal on loading banks and lifted into railway wagons, while the power to transfer them slumbers uselessly under the motor bonnet, and is the same primitive process to be gone through at the arrival station when the goods are to be transferred to motor wagons for delivery? Judging by the past it is quite conceivable.

Every day's delay will make the standardization more difficult, and absence of standardization spells evil. For it is indeed certain that without organization between the two modes of transit no uniformity will be established, and if uniformity be not established, improvement will be delayed, with the result that in the meantime much capital will be wasted in un-

suitable plant, and time and money will be daily wasted in carrying on a service which is not the best as regards either economy or efficiency.

Of course it will be said that there is a large quantity of plant, both on the rail and on the road, which might have to be altered or even scrapped, if a general system were devised and adopted. But is it not well worth considering whether this is not the best and the cheapest course in the end? Surely we may learn the lesson that our trans-Atlantic friends have taught us, that to scrap what is not the best obtainable is a paying policy. It is earnestly to be hoped that commercial motor manufacturers and railway engineers will now—today—take up this question and deal with it comprehensively and thoroughly. The devising of a system, where at present there is no system, is of importance to the public whose work has to be done, and to those who undertake to do it. It would be well if they would combine and offer a handsome set of premiums for the best designs for transit of goods from power road vehicle to goods train and vice versa, without delays in transhipment, and without the damage which too often is the result of breaking bulk. The most rapid and convenient system must be the cheapest, and if it were reached would soon repay the cost of a change of appliances.

To the writer the system which suggests itself as most likely to prove successful is one in which the body of motor wagon can be moved horizontally on to the railroad truck, the wagon's motor power being used to draw it off the one on to the other. The frame of the motor wagon and the floor of the truck would have a set of rollers projecting slightly above the floor, and the load would be hauled over the rollers, as is done in a hearse when a coffin is rolled in and out of it. The motor would be used to warp the load on and off by a small capstan drum and wire rope. The detail in doing this should not present any difficulty. It would, of course, be necessary to have the two floors at nearly the same level when brought together; but this could be accomplished in the same way as is now done for running gentlemen's carriages or furniture vans on to railway trucks.

It will be seen also that such an arrangement would be most convenient for the merchant who sends goods out of his premises, whether to go by road or rail. He would be able to use one frame and motor to run two goods carrying bodies, the second one being loaded while the first was out for delivering, the empty body being brought back and run off to be reloaded, and the loaded one run on to go out for the second delivery. Thus one machine would do double haulage work and this would reduce cost.

But whatever may be the system to be adopted, what it is desired to press is that there should be a system, that it should be a general system, and that it is false economy to have no system in which the great conveniences of the power vehicle are utilized for rapid and easy transfer of goods in bulk. Shall the appeal be made in vain to the Commercial Motor Users' Association to take this matter up without delay, and to have it dealt with as its importance demands? Every day that passes without its being given practical attention will make it more difficult to deal with.

GENERAL NEWS FROM ABROAD.

British Truck Show—The Society of Motor Manufacturers & Traders in Great Britain is organizing an international commercial vehicle exhibition to be held at Olympia, London, England, beginning July 19. It is anticipated that all the leading gasoline, steam and electric trucks made or represented in the United Kingdom, will be on display, as well as a complete line of accessories adapted for these machines.

Public Vehicles in Australia—The postoffice department in Sydney, Australia, is using two two-ton motor trucks for conveying mail matter in bulk from the wharves to the postoffice and to the railway stations. Plans are being made for the addition of several 16 horsepower closed vans of 1000 pounds capacity for collecting and transporting parcel post packages in and around Sydney. The city corporation now utilizes four five-ton street cleaning machines and two four-ton refuse wagons, and these has proven so satisfactory that several more will be ordered.

Truck Trials in Belgium—The Royal Motor Club of Belgium has revived its plan to hold an international competition for freight automobiles some time during the current year. It is several years since similar trials were held in Belgium, although an unsuccessful attempt was made in 1912.

Servian Military Commission—The Servian ministry of war is to send a military commission to the various automobile producing countries for the purpose of selecting the type of motor truck best adapted to the requirements of the Servian army. An appropriation of $2,000,000 has been made for the purchase of vehicles, and delivery will be requested as speedily as possible after orders are given.

Germany Needs Skilled Labor—According to the Borsen Zeitung, a German newspaper, German automobile manufacturers are exceedingly busy and complaints are being made as to the lack of skilled workmen. The home demand is increasing rapidly, and during the first two months of 1913 the exports to Russia and Argentine nearly doubled, while those to Belgium were trebled.

State to Establish Motor Lines—The government of Saxony, Germany, contemplates the creation of a network of state motor lines within the kingdom, provided the necessary appropriation can be secured from the parliament. The success of similar lines in Bavaria, which in some cases has resulted in the complete substitution for railroad, has carried much weight with the Saxon officials.

Transportation of Grapes—Several vineyard owners in Mendoza, Italy, have adapted the motor vehicle for the transportation of grapes. The main feature of the construction lies in use of a large air tight tank, located so that the load is carried on the rear axle. This effectually protects the grapes from the ravishes of insects during transport.

Road Construction in India—Owing to the increased use of motor vehicles of all types in India, in which the American product is well represented, the government of India has allotted a sum of 3,000,000 rupees ($973,300) to be used in the construction of roads. It is understood that this is but a beginning and that the total amount eventually to be expended in this work will reach 35,000,000 rupees ($11,355,200). Following this announcement comes the information that the market in Burma is particularly promising.

Electric Refuse Wagons in Paris—The municipal council in Paris, France, is giving a new electric front drive refuse wagon an official test, the reason for this action lying in the difficulty of securing a gasoline machine which will operate economically at the low rate of speed necessary for the collection of garbage. The tank body is made entirely of metal, the cover being in four sections, so that it is unnecessary to open but a small portion at any one time.

New Commercial Car Accessories

Lee Grease Pot.

H. B. Lee of New London, Conn., is marketing a grease pot which is designed for filling differentials, transmissions, etc. The pot is mounted on a board, eight by 20 inches, and its body is seven by seven inches of cast iron. The plunger is six inches in diameter and its displacement is such that a large amount of lubricant is forced quickly to the part. The plunger is retained by a crossbar, hinged to the pot at both ends, although either side may be removed. When the cylinder is filled with grease the plunger member is closed down and the screw turned. This forces the lubricant through a flexible metal tube to the part to be filled. The Lee grease pot is made in two styles, one for light grease and oil, and the other for heavy lubricants.

Kennedy Carburetor.

The elimination of springs, etc., easy starting in all temperatures, simplicity of adjustment and fireproof construction, are features claimed for the Kennedy carburetor, manufactured by the L. D. Robbins Company, Lynn, Mass., for which F. Shirley Boyd, 903 Boylston street, Boston, is agent. There are but two adjustments, high and low, and a single air inlet. The latter is provided with a full size hot air tube leading to the exhaust pipe of the motor and in the event of a backfire the danger of fire is reduced to a minimum. Easy starting qualities are secured through an accumulation of fuel below the gasoline level, which provides a rich mixture. This puddle forms automatically on stopping the motor. One of the features claimed for the carburetor is the use of a by-pass tube for providing the proper mixture at low speeds. The Kennedy is made in standard sizes, nicely finished and is held to be very economical of fuel.

Bosch Spark Plug.

Much of the efficiency of the ignition system depends upon the spark plug and the maintenance of the proper gap. When the source of current supply is a magneto the points of the plug are subject to more or less heat, varying in intensity according to the speed of the magneto. The Bosch Magneto Company, 225 West Forty-sixth street, New York City, is marketing the Bosch spark plug, which is designed to withstand severe service and although constructed for magneto work may be utilized with battery system as well. One of the qualities of the plug is the use of steatite as an insulator, a material which is forced into the shell under high pressure and one that is held to be indestructible. The method of fitting also makes for an absolutely gas tight construction. The electrodes are a high grade, durable nickel alloy, a metal especially adapted to high temperatures, and there are three of these. The electrodes of the shell terminate in a knife edge and the spark does not jump at any one particular point, but forms a ribbon of flame in its passage to the main member. Sooting is prevented as the electrodes are maintained at a high temperature, burning away any lubricant, etc., that may gather. The plugs are made in various sizes, these including 18 mm metric, .5 inch and .875 inch A. L. A. M. threads.

S. & M. Puncture Proof Tire.

The S. & M. Tire & Rubber Company, Akron, O., is manufacturing the S. & M. puncture proof tire which is, as the name implies, held to be impervious to punctures. It is of the pneumatic type and employs the same size inner tube as the conventional shoe. The side walls are made in two parts and the upper and lower extremities are provided with beads for retaining the parts to the regular rim on the felloe and the upper member. The latter is of metal and is provided with a rubber cushion tread band cured to the metal. As this is the traction member it is stated that punctures are impossible and that the fabric of the shoe is relieved from undesirable stresses occasioned by contact with stones, etc. It is also claimed that the tire will not blow-out. Large mileage and freedom from the usual tire troubles are emphasized in the S. & M. shoe, which is made in various sizes.

Morgan Garage Jack.

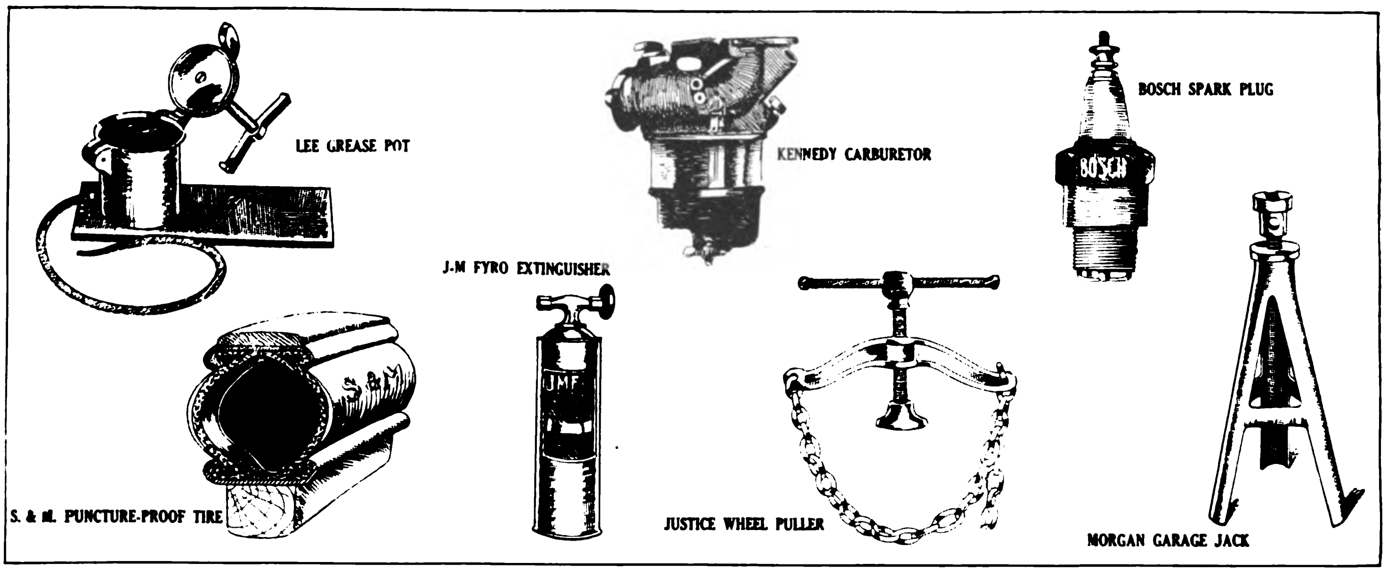
A new type of garage jack is being marketed by the Morgan Manufacturing Company, Newport, R. I., it differing from usual construction in that the base is wide and designed to prevent slipping. The base is composed of three legs and the space between them is such that the jack may be subjected to considerable side movement or swaying without tipping. The jack head is made with a recess wide enough for the chassis to fit into it and throughout the best of material is employed. The height of the jack is 20.5 inches and it has an extension of nine.

Justice Wheel Puller.

A wheel puller that is stated to have a capacity of seven tons is the Justice, manufactured by P. S. Justice & Co., 421 Chestnut street, Philadelphia. It is provided with a small round base attached to the screw member and the former may be displaced if desired by removing a set screw. Instead of arms or yokes a chain is employed and this is adjustable. It is operated in the usual manner, the chain being fitted around the hub of the wheel and the screw end applied to the axle or part. The travel of the screw member is four inches, width of yoke 16.5, diameter of base four and weight 24 pounds. The chain is 11 feet long.

J-M Fyro Extinguisher.

A new chemical fire extinguisher of the one-quart type, known as the J-M Fyro, has been brought out by the H. W. Johns-Manville Company, Madison avenue and Forty-first street, New York City. Because of its lightness and compactness it is specially adapted to be carried in the automobile or stored in the garage. It differs from the usual extinguisher in that compressed air is employed for discharging the extinguishing fluid. The latter is a liquid gas, five times as heavy as air, and on account of its weight quickly envelopes the flames, displacing the oxygen. When thrown on a fire it instantly volatilizes, forming a dense combustion arresting gas in which flames cannot live. It is claimed that one quart of the J-M Fyro liquid will expand to 4000 cubic feet of fire annihilating gas and that one quart of ordinary extinguishing fluid will make only 1000 feet. It is held to be especially effective on naphtha, oil, varnish, gasoline, calcium chloride and electrical fires. It is non-corrosive and will not injure metals, fabrics or furnishings. A feature of the Fyro is that it does not deteriorate and is not affected by differing temperatures.



Illustrating Some of the More Recent Accessories Designed for Commercial Vehicles and the Service Station.

THE A B C OF MOTOR TRUCK IGNITION.

Part X---The Mechanical Generator or Magneto---How Current Is Induced in the Windings of the Armature by Cutting the Lines of Force or Magnetism ---Permanent and Electro Magnets.

By C. P. Shattuck.

THE magneto utilized for ignition purposes in connection with the internal combustion engine is regarded as a mysterious instrument by the majority of car operators. They know that with the motor operating it supplies current for ignition, and that the supply ceases when the switch lever is moved to a certain position and the engine stops. Many who can clean and adjust the components of a magneto, such as the breaker box and distributor, and who can time the instrument, are not familiar with the principles involved. This lack of knowledge is not confined to the novice, but many who understand the practical side of the magneto cannot explain how the current is obtained.

While magnetos rarely give trouble, it is well to understand the principles involved, the relation the parts bear to one another, so that in the event of accident one will be able to cope successfully with the situation. Failure to comply with the instructions of the makers as to care and maintenance is likely to result in failure of the magneto and this usually occurs at the most inopportune time and where the services of the expert are not easily secured.

Advantages of Magnetos.

Some drivers believe that many of the so-called dual systems, batteries and a magneto, provide two independent ignition systems, either of which may be utilized. This is not true, for when the instrument is employed to interrupt the primary circuit and to distribute the high-tension current, any disarrangement of the working parts will result in inefficiency. The general terms applied to the various ignition systems are somewhat misleading, low and high-tension systems often being confounded. It is the intention of the writer to discuss the various types of magnetos, describing their construction, installation, operation and maintenance, and to present the advantages claimed for each, as well as giving instructions for correcting troubles.

The advantages of a mechanical generator over the battery and coil systems previously described are numerous. It eliminates minor troubles to which the coil and battery system is subject, provides an inexhaustible supply of current and develops electrical energy proportionately to the speed at which it is driven. Its efficiency has relegated the older form of ignition to second place and it is rare that a modern machine is not equipped with some form of a mechanical generator.

To properly understand the forces involved in the generation of electrical energy by mechanical means, a knowledge of magnetism is necessary. Magnetism and electricity are very closely allied; in fact, it is held by some authorities that the former is electricity in rotary motion. Certain substances, such as iron, steel, nickel, cobalt and their alloys show magnetic properties. The magnet was first known to the ancients in its natural form, the loadstone. They observed the difference in polarity, and also noted the repulsion existing between similar poles and the attraction between dissimilar.

Magnetic Influence.

In experimenting with the small horseshoe magnets sold as toys, it will be noted that when a small piece of iron or steel is brought within the zone of the magnetic influence it is quickly attracted to the magnet. The latter, however, has no effect upon a piece of brass, copper, tin or zinc. If the ordinary bar

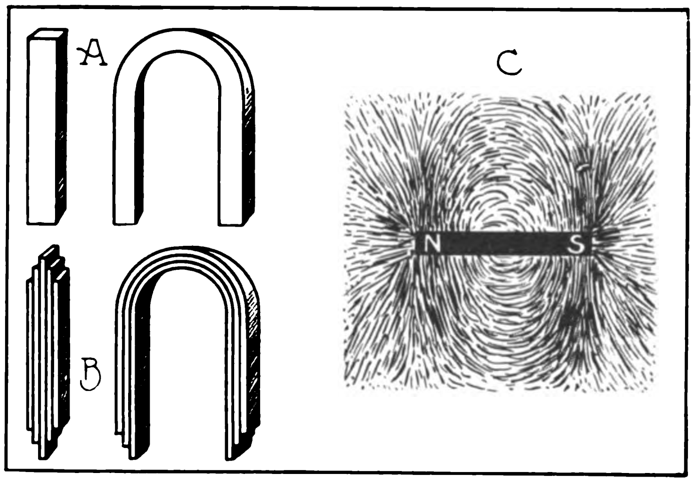


Fig. 50—Forms of Magnets and Field of Magnetic Influence: A, Simple Magnets; B, Compound; C, Illustrating Magnetic Influence of a Bar Magnet.

or horseshoe magnet be carefully examined one end will be found to be marked N, indicating the north pole. The other extremity is the south pole. If the south pole of one magnet be brought near the north pole of another a strong attraction, varying with the size and the power of the magnets, will be found present. But if this south pole be brought near a like pole of another magnet, instead of there being a strong attraction there will be noted a repulsion of like force.

From this it may be deduced that a magnet will only attract or repel a substance possessed of the same qualities; that the like poles of magnets will repel each other because of the obvious impossibility of uniting two influences flowing in opposite directions; also, the unlike poles of a magnet will, however, attract each other, because there is a continuation of the

flow of the influence of the magnet through both. This indicates that the flow of magnetism is through the magnet from the south to north and the circuit is completed by the flow of the potential or influence through the ether from the north to the south pole.

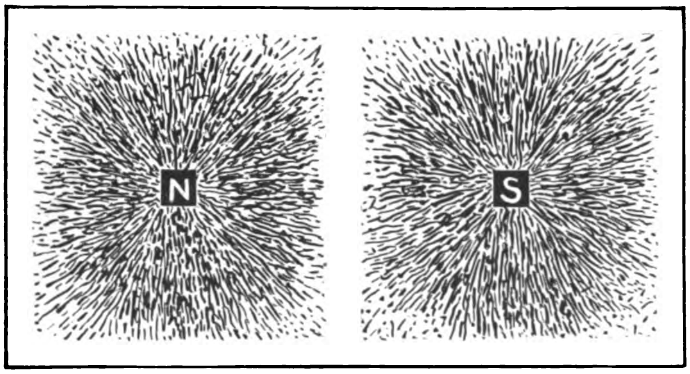


Fig. 51—Illustrating That the Magnetic Influence Is Stronger at the Poles, by Utilizing Iron Filings.

Magnets are constructed either in the shape of a straight bar or a horseshoe and these two forms are made in two types, simple and compound. The core of a spark coil is an example of a bar magnet, while the field pieces of a magneto are magnets of the horseshoe type. A compound magnet is one that is composed of a number of magnets so united that the ends of polarity are together. This form is favored because of its great efficiency and it has more magnetic strength than a simple magnet. The core of an induction coil, which is composed of a number of small pieces of iron wire, is an example of the compound magnet. Simple and compound magnets are shown at Fig. 50 A and B, respectively.

Types of Magnets.

There are two types of magnets, the electro and the permanent, although the basic principles upon which their construction and operation depend are the same. The mechanical generators employed for ignition work are known as dynamos or magnetos and are easily distinguished from each other by their construction. A dynamo has an electro-magnet which is known as a field magnet to produce the magnetic field, whereas in a magneto this field is produced by means of permanent magnets. The current is created in a dynamo by electro-magnetic production and in a magneto by magneto-electric induction. The permanent magnet is a piece of steel which has been charged with magnetism, and retains it, and is favored because it can be made more compact and lighter than the dynamo.

How Magnetism Is Produced.

Magnetism may be produced either by contact or induction. A piece of steel will retain the magnetism imparted to it for a considerable time and this is known as residual magnetism. If a piece of steel were brought within the magnetic field of a powerful magnet and allowed to remain within its influence for some time, when removed it would be found to be a magnet. This is magnetization by means of magnetic induction. If a strong electric current were made to flow through an insulated conductor wound around a piece of iron or steel it would make a magnet of it. This is magnetization by means of electro-magnetic induction, and a magnet made in this manner is termed an electro-magnet. If, however, a piece of soft or wrought iron were substituted for steel in the above cases upon removal from the magnetic influences it would retain but very little magnetism.

Lines of Force.

It has been explained that the flow of magnetism or lines of force of a magnet is from the south to the north in the body of the magnet and from the north to the south outside it. It is assumed that these lines are imaginary, but they can be made visible by a simple experiment. If a piece of cardboard sprinkled with iron filings be placed on a straight bar magnet and tapped lightly the filings will be observed to take a position similar to that at Fig. 50 C. The lines of filings should not be confounded with lines of force, for many of the lines seem to break off and do not form closed curves. If each line of filings be considered a tube of force made up of a number of lines of force, the broken lines are easily accounted for. A single line of force has not sufficient strength to move the small particle of iron, but the combined action of a number of lines or a tube of force is sufficient, and the iron is moved to a new position. Near the magnet the lines of force are more dense than at a distance, and here the lines of filings are very distinct. At a distance from the magnet the lines are more scattered and are too far apart for their combined strengths to move the particle. Therefore, while the lines of filings break off, the lines of force must be conceived to continue across the gap.

The passing of a current of electricity produces a condition of more or less strain, or whirl in the ether, and unless distorted in some way the locality of the condition is symmetrical with respect to the current. This locality is called the field of force and is considered apart from the magnet and is a magnetic field, the strength of which is measured by the number of lines of force which exist in a square centimeter of that field.

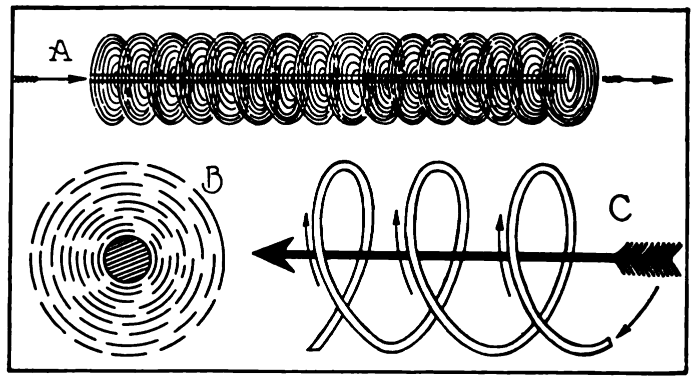


Fig. 52—Lines of Force: A, Those Surrounding an Active Conductor, the Arrows Indicating the Direction of the Current; B, End View of Same; C, Current Passing Through a Spiral Conductor.

It was discovered by Faraday that if a circuit of copper wire be caused to cut these lines of force in the magnetic field, an electric current should be set up in

the wire, and this action is termed magneto-electric induction. If the free ends of a coil of wire be connected to a galvanometer, and a magnet be thrust into the coil, a certain deflection of the needle of the galvanometer will take place, continuing only while the magnet is in motion. After inserting the magnet and upon it coming to a rest, the needle will return to its normal position. When the magnet is withdrawn the deflection of the needle will be in the opposite direction. If the magnet be inserted and withdrawn with a very quick motion, the deflection will be considerable, but will hardly be noticeable with a slow movement. The same phenomena will occur if instead of moving the magnet, it is held stationary and the coil moved, or if both of them be moved towards or from each other. The deflection of the needle indicates that a current of electricity is passing along the wire, and the experiment above described shows exactly how currents of electricity are produced in generators.

Magnetic Field.

It has been explained that a magnet is constantly surrounded by a magnetic field and that an electrical

path of least resistance, and with a given magnetizing force the intensity of the resulting magnetism is enormously increased by the presence of iron. It is for this reason that iron is utilized in the field magnets of dynamos and motors, and it is of the greatest importance that the magnetic circuit or path over which the lines of force pass shall have a large cross section and a low resistance.

Whenever a conductor of electricity is passed through the field of force surrounding a magnet, at right angles to the lines, an electromotive force is set up in it, depending upon the length of the conductor, the speed at which it moves and the intensity of the field.

Shuttle Type Armature.

The simplest form of armature is the shuttle, it consisting of a single coil of wire wound lengthwise. In practise the armature of the shuttle type of magneto is provided with two deep, longitudinal grooves, one diametrically opposite the other, so that the transverse section looks something like the letter H.

A part sectional view of a magneto is shown at Fig.

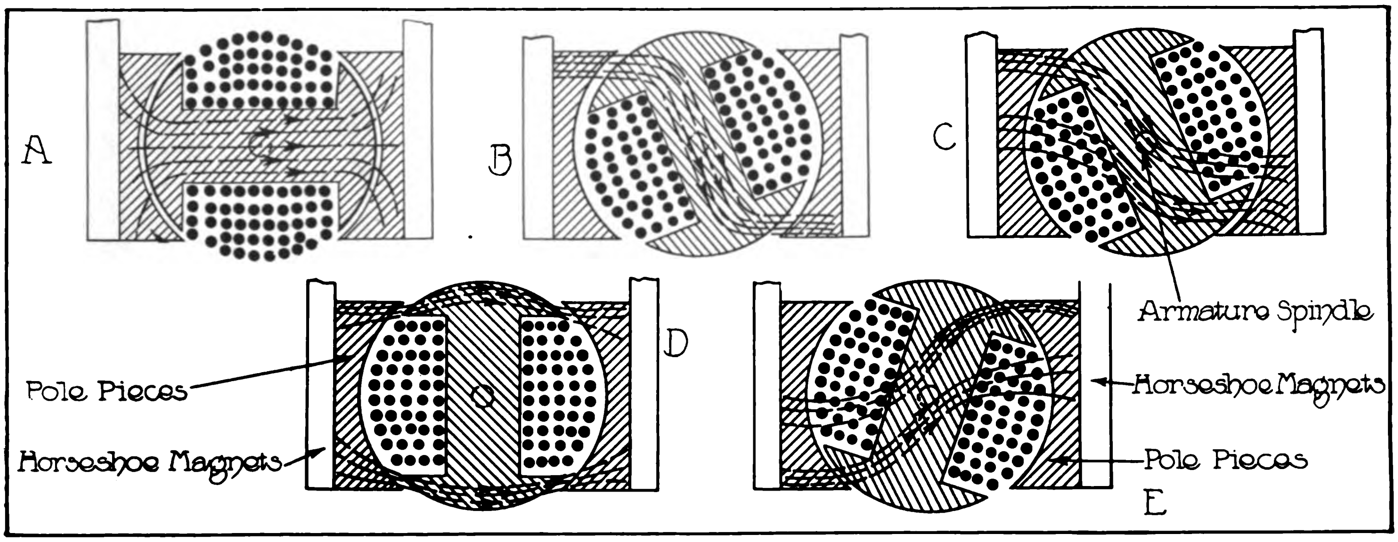


Fig. 53—Showing Changes in Magnetic Field—the Strength, Magnetic Influence and Current Induced in the Windings Vary with the Rapidity of Changes of Flow.

conductor when carrying a current is also surrounded by a field of magnetic influence. If the conductor carrying a current of electricity will induce magnetism in a bar of iron or steel, by a reversal of this process a magnetized iron or steel bar will induce a current of electricity in a conductor. It is on this principle that the modern dynamo or magneto is constructed. Electricity may be induced in a conductor by the following methods: If an electromotive force is induced in a conductor by moving it across a field of magnetic influence, or by passing a magnetic field near a conductor, electricity is said to be generated by magneto-electric induction. All mechanical generators of electric current using permanent steel magnets to produce a field of magnetic influence are of this type.

Lines of Force.

Lines of force do not pass with equal facility through all substances, most bodies offering a high resistance to them, but iron, steel and nickel are good magnetic conductors. Magnetism always follows the

53, it being of the horseshoe magnet type with a single wire winding of the armature. The magnets which produce the influence that in turn induces electrical energy in the windings or loops of wire on the armature, and which may have any even number of opposed poles, are called field magnets. The rotation of the armature in the field of magnetic influence cuts the lines of force, and the exposed ends of the magnets are called pole pieces. These are utilized to collect or concentrate the magnetic influence of the various magnets. The stationary pieces which bear against the collector or commutator, acting as terminals for the outside circuit, are called brushes. These brushes are usually of copper, or some of its alloys, because copper has a greater electrical conductivity than has any other metal.

In some cases the brushes are made of carbon, which is electroplated with copper to increase its electrical conductivity. Carbon is used as it is not so liable to cut the metal of the commutator as with a

metal to metal contact. Carbon also assists in the lubrication of the commutator and will wear and conform to any irregularities on the surface of the metal.

The coils of wire on the shuttle member are insulated and comprise a large number of turns, and the current produced depends in a great measure upon the size of the wire and the number of turns a coil. An armature with a winding of comparatively large wire will deliver a current of great amperage, but of small voltage. One wound with very fine wire will deliver a current of high voltage, but of low amperage.

Generation of the Current.

It will be seen that the crossbar of the core of the armature provides a conductor for the magnetic energy, regardless of its position, though the facility with which the influence will be transmitted depends entirely upon the position of the core. When it lies transversely between the pole pieces, as shown at Fig. 53 A, the lines of force run directly through it. Even when the armature has rotated to the position shown at B, the bulk of the lines will prefer to take the distorted path through the core instead of running directly across from pole to pole through the air.

But while the core is turning from this position to about vertical, as shown at C, the loops of wire will cut all the lines of force. The uppermost lines of force starting from the north pole will jump from the lower part of the south pole to the upper part thereof; and the lowermost lines of force entering the south pole will drop from the upper to the lower part of the north pole. As each jump and drop takes place, the lines of force are cut by the coils of the armature winding, and a current is set up therein. By the time the core has reached a vertical position as shown at D, which is attained every half revolution, the lines of force divide into two parts, one passing through the upper segment of the armature and the other through the lower.

As the armature continues its movement, the cutting begins again, but in an opposite way, both as to the lines and the coil, so that the current continues to flow in the same direction, but with decreasing intensity. Upon the core attaining a horizontal position the induced current practically ceases, but a further rotation of the armature results in the restarting of the current, which flows in an opposite direction. The currents are at their strongest or maximum at the time when the most lines of force are being cut, or about the time the core assumes its vertical positions, and it is during one of these two times that the current is generally utilized. When no lines of force are being cut, the voltage falls to zero. It will be seen that the greatest changes in the strength of the field occur as the armature passes from B to E, because during that time the magnetic field existing around the core will be destroyed and again re-established.

(To Be Continued.)

Ed. Note—The next installment will deal with the various types of low-tension magnetos.

KISSELKAR GRINDS GRAIN.

Minnesota Farmer Saves $200 a Year on Grain Bill Aside from Regular Work.

A striking illustration of the emergency value of the motor truck is shown by an experience of William Kresch, a farmer living below South St. Paul, Minn., who bought a KisselKar one-ton wagon and placed it in service Aug. 1, 1912. While pleased with the efficiency of the machine, he disliked having his investment tied up during the winter. Finally he solved this problem by jacking up the rear end, blocking the front so it would not move, taking off one tire, making a light wood block around the wheel, attaching a belt to it and ground feed, so that he could saw wood, cut fodder, etc.

Mr. Kresch ground, with the motive power of his truck, 100 sacks of feed every week. It formerly cost him six cents a sack to have this work done and he had to carry it four miles to the mill and back. This occupied the biggest part of a day. It now takes him two hours to grind his 100 sacks at a fuel expense of 60 cents, representing three gallons of gasoline and one quart of lubricating oil. Here is the way he has figured out his saving. One hundred sacks of feed at six cents a sack, $6; time saved, man and team, one-half day, $1.50; total, $7.50.

Against this he placed the cost of fuel and a helper's time at 15 cents an hour, 30 cents, a total of 90 cents. This leaves a net saving of $6.60. He has repeated this operation every week for 31 weeks, which gives him a saving for the year of $204.60. This not only wipes out the interest on his truck investment, but leaves him more than enough to take care of any amount of overhauling and repairs that could normally be necessary. Besides this he has his KisselKar in actual road service seven months of the year doing from twice to three times the work a good team of horses could do.

The Willet Engine & Truck Company has succeeded the Willet Engine & Carburetor Company and the company has removed from 60 Terrace to its new factory at 6-8 Lock street, Buffalo, N. Y. The company has begun the manufacture of the Willet chassis of two tons capacity. Other sizes will shortly be produced.

The Miner, Read & Tullock Company, New Haven, Conn., has the largest fleet of motor trucks used by any firm in that city. They are utilized in all branches of the firm's cartage and delivery system. The recent purchase of a Moeller machine, made by the New Haven Truck & Auto Works of that city, makes six of the same make now in use by the company, which was the first to purchase a locally manufactured truck in 1910. The concern is now able to handle business which heretofore was impossible owing to lack of facilities for delivery to distant points.

HINTS FOR PROPER MAINTENANCE.

ADJUSTING ROLLER BEARINGS.

Roller bearings are fitted to the front wheels of several makes of cars and while the average driver understands the adjustment of bearings of the ball type, he is prone to apply the same methods when eliminating play from the roller members. The construction of the latter, such as employed on light delivery cars, is shown at Fig. 1 and with the parts clearly marked.

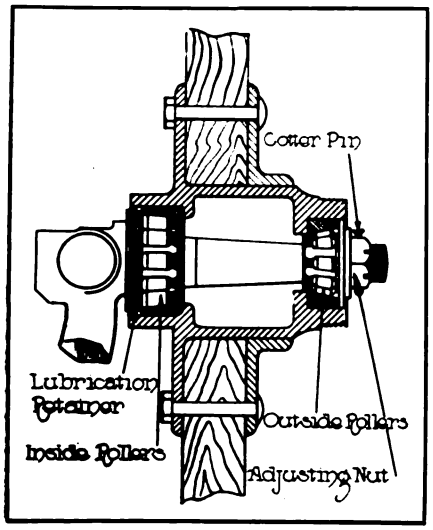


Fig. 1—Adjusting Roller Bearings.

To ascertain if the bearings require adjusting, jack up the wheels and rock them sideways, taking care not to confound wear of the spindle with that of the rollers, etc. If the wheels are loose, remove the hub cap and clean the grease from the locking nut so that the cotter pin may be removed easily. The pin should be so displaced that it may be utilized again.

To tighten the bearing, rotate the wheel, and at the same time screw down the notched adjusting not until the bearing is sufficiently snug to stop the movement of the wheel. Next slack off the nut, but only enough to allow the wheel to spin freely. Lock and replace cotter pin. It is better to have the bearing slightly loose than too tight as the rollers may be injured. Do not use so much grease in replacing the hub caps as to prevent its being screwed up home, as loss of the cap is apt to follow.

ADJUSTING TIERODS.

Alignment of the wheels is important, especially when they are shod with pneumatic tires. While the modern car is provided with adjustable tierods, there are a number of older types which have been converted into commercial vehicles and which are not equipped with means for aligning the front wheels. In the event of an accident, such as running too close to the curb, etc., the steering arm is likely to become bent, throwing the wheels out of line. If allowed to remain in this condition the tread of the shoe is destroyed because of the misalignment.

The usual practise is to bend the steering arms when the tierod is not adjustable, but this is not to be recommended. The rod may be made adjustable at slight expense and Fig. 2 illustrates methods applicable to those of the solid and tube type.

That at A is a tierod constructed of tubing which is cut near the yoke to permit of incorporating the parts B and C. The former is prepared by taking a round piece of steel and making a driving fit into the tubing, after which the piece is pinned and brazed, also threaded and a nut fitted. At C is shown the other section of the rod, and it will be noted that the inserted member is slightly larger and is tapped to take the screw bolt. With this construction it is a simple matter to lengthen or shorten the tierod by removing one yoke from the knuckle and screwing the yoke section in or out as desired, after which the lock nut is set up hard. Care should be taken to see that the yokes do not bind after locking the parts.

If the tierod be solid the plan at D may be utilized. The rod is cut and one end tapped as shown in the drawing, while the other end is turned down and threaded to fit the first part. The assembly of the rod is shown at E. It will not be necessary to cut a long thread for adjustment as a slight increase or decrease of length will be sufficient to secure the desired alignment.

STARTING ON HEAVY FUELS.

The subject of using kerosene for a motor fuel is receiving considerable attention in these days of the high price of gasoline and among the devices utilized abroad for starting a cold motor on the heavy fluid is that shown at Fig. 3. It has been in service and the maker claims that starting troubles are overcome. As will be noted by the drawing it is a valve device by means of which gasoline is fed to the intake pipe or manifold of the motor. It is screwed into the intake pipe and the source of fuel supply is a small container located on the dash or in some other convenient place.

The device includes a valve which is normally held closed by a spring, but it may be opened when desired by a cord or wire. The latter is led to the front of the car near the starting handle, and when the driver wishes to start the motor the control cord is pulled, releasing the valve and allowing a small amount of

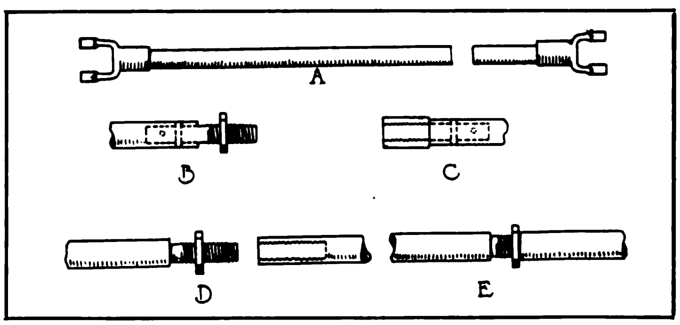


Fig. 2—Converting Tierods into Adjustable Members: A, Where the Cut Should Be Made; B and C, Method Applicable to Tierod Constructed of Tubing; D, Plan for Solid Member; E, Showing Parts Assembled and Locking Nut in Place.

gasoline to flow into the intake manifold. This is held to secure the preliminary explosions, after which the motor is supposed to operate on the combined mixture

of gasoline and kerosene supplied by the regular tank.

Details are not at hand concerning the dimensions of the openings into the intake manifold or the amount of gasoline used. The design is similar to several

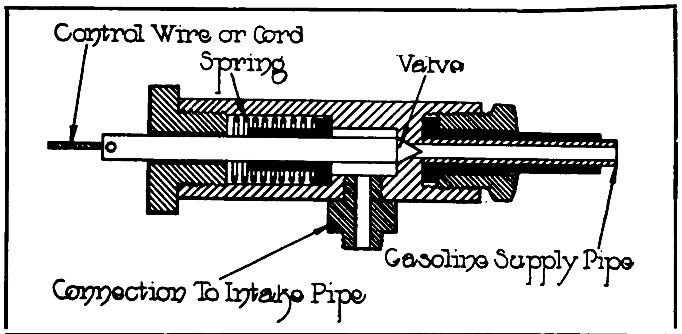


Fig. 3—Valve Device for Priming Intake Manifold with Gasoline to Secure Preliminary Explosions When a Heavy Fuel Is Employed.

priming devices made in this country for starting the motor on gasoline in cold weather. Presumably the operator acquires by experience the knowledge of how much gasoline to use to secure the preliminary explosions.

REPAIRING CRACKED CYLINDERS.

The usual practise in repairing cracked cylinders is to employ the autogeneous or welding process, although iron cements, etc., are utilized, depending upon the nature of the fracture. The Commercial Motor, an English publication, prints the following suggestion, which may be of service where a small crack is to be mended and when there is not time to send the part to be welded:

Drill and tap a small hole at each end of the crack to prevent further extension of the weakness, and screw in an iron stud. Next clean the outside and inside of the fracture very thoroughly, using a scraper and gasoline. File up some soft copper and fill the crack, heaping the filings over it. Then take a powerful blow lamp or a torch and direct the flame on the copper. By this method a fair amount of metal can be worked into the opening. After cooling, the studs are cut off flush and the copper filed smooth as shown at Fig. 4. It is said that the repair will endure indefinitely.

SOFTENING CAST IRON.

To soften cast iron for drilling, heat the part to a cherry red, and have it lie level in the fire. Then with the tongs put on a piece of brimstone, a little smaller in size than the hole to be drilled. This softens the iron entirely through. Let the piece remain in the fire until cooled.

ALUMINUM-BRONZE CASTINGS.

Discussing the making of aluminum-bronze castings, the Brass World gives some useful hints which are not generally known. The copper and aluminum, in the proportions of nine to one, should each be as pure as possible. The former should be melted first in a graphite crucible without flux, but covered with charcoal to prevent oxidation. The latter is then added and the mass well stirred with a graphite rod. Scrap metal may then be added, and the whole ingoted. When remelting, which is necessary, the heat is kept covered with charcoal, to prevent oxidation, and at proper temperature the metal is poured. It should not be allowed to soak.

Green sand molds are found to give better results than dry, although the sand itself should be dry and soft. Large risers are essential, and it is also necessary to pour quietly, and therefore, as a rule, slowly, and preferably from the bottom. The chief cause of trouble in aluminum-bronze castings is oxide, which can be reduced by preventing bubbling actions, and when formed, prevented from mixing with the body of the metal by quiet pouring. It should be poured cool with the molds laid flat, not on end.

SELF-HARDENING CUTTING TOOLS.

Some machinists complain about self-hardening steel cutting tools, stating that it is impossible to accomplish fine results in turned or planed work with them. While this is true, they are valuable for medium cuts and feeds and coarse thread cutting, machining cast iron in the shaper, planer or lathe, for turning brass castings and for different operations on cast iron parts.

FITTING WIRES OR CABLES.

In rewiring the car and when the leads pass through the battery box, floorboards, etc., it is sometimes difficult to start the wire through the opening because the diameter is less than that of the lead. The usual practise is to ream the hole larger. When wires are slightly smaller than the opening they may be started by placing the end to be inserted on a flat, hard

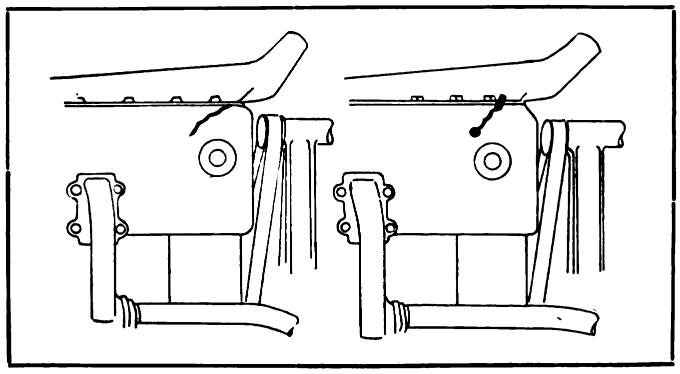


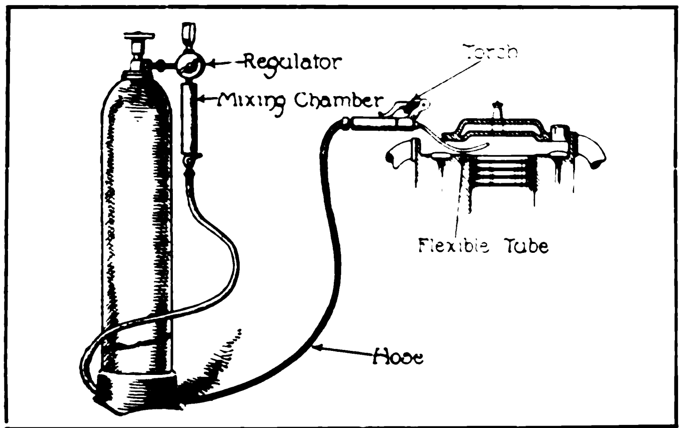
Fig. 4—Method of Repairing Cracked Cylinder by Fusing Copper Filings.

surface and rolling the insulation with another piece of hard, flat material. This will constrict the end of the insulation so that it may be readily inserted and drawn through with little effort.

GARAGE AND SERVICE STATION EQUIPMENT.

OZO, A CARBON DISSOLVENT.

Time and labor saving equipment is necessary in the repair shop catering to commercial car work because it is imperative that the repairs on the machine



Ozo Carbon Destroying Outfit, Utilization of Which Removes Deposits Without Displacing Cylinders, Etc.

be completed as quickly as possible. The loss of a few hours during the day is not desirable, especially if the car is the only one in service.

There is certain work that must be done on the gasoline vehicle periodically, such as removing the carbon from the cylinders, etc. The usual practise is to remove the cylinders, a method requiring considerable time, to say nothing of expense. Sometimes it is possible to introduce scrapers through the valve cap openings, but the more thorough method includes disassembling the motor. A carbon removing outfit has been brought out by the Ozo Company, 18 Tremont street, Boston, and with it it is possible to destroy carbon and soot deposits without displacing the cylinders, the work involving but the removal of the spark plugs or valve caps.

The Ozo outfit is shown in an accompanying illustration and the system does not include chemicals or liquids, a harmless gas being introduced into the cylinders, where it burns the carbon and without any accompanying flame. The gas is stored in a cylinder having suitable control valves, etc., and a retarding chamber or regulator is also included for reducing the pressure as desired.

The gas flows through a rubber hose to the automatic torch, attached to a flexible tube, which is inserted through the spark plug or valve cap opening, and unites with the carbon, destroying the latter entirely. Suitable controls are provided for the workman and the operation is so simple that it may be mastered in a very short time by the most inexperienced.

One of the features of the system is that it completely removes all carbon, and from places where it is not easily detached by the scraping process. The time required to complete the work varies according to the condition and number of cylinders. It is stated that the average four-cylinder motor can be cleaned in approximately 20 minutes.

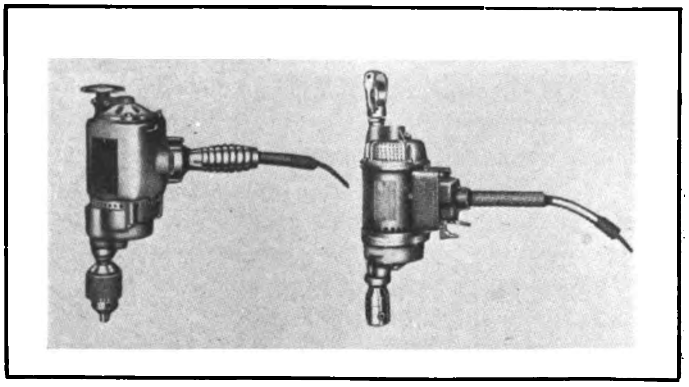
The Ozo method has been adopted by a number of garages and service stations and its principle is similar to that employed abroad.

UNIVERSAL ELECTRIC DRILLS.

Electricity as a source of power has numerous advantages and there is a growing tendency to use this form of energy for operating new machinery, such as drills, grinders, compressors, etc. In considering the equipment it is essential that it be determined whether the current is alternating or direct. The voltage, etc., also must be known. When the workman is sent to a private garage to complete some repairs and when the work requires the use of a drill for example, it will not be possible to utilize a tool operated by a direct current with an alternating source of supply.

The Chicago Pneumatic Tool Company, Chicago, is manufacturing what are termed universal electric drills capable of being operated on direct or alternating currents and two types are presented in the accompanying illustration. That shown at the left has a .25-inch capacity for metal work. It is adapted for either 110 or 220 volts and when operating at its maximum capacity the speed is 600 revolutions a minute. The equipment comprises a breast plate, chuck to take straight shank drills up to .25 inch diameter, and 10 feet of electrical conductor with an Edison connector. The drill weighs about seven pounds, is about 10 inches in height from breast plate to the end of the chuck, and consumes approximately 170 watts at full load.

That shown at the right in the drawnig is adapted for drilling holes in metal up to .5 inch and rotates at 450 revolutions a minute when operating at its maximum capacity. The equipment comprises a spade handle, No. 1 chuck, 10 feet of cord and fused connector, and two extra fuses. A breast plate is supplied in place of the spade handle when desired. The weight of the drill is 22 pounds and the shortest length from breast plate to end of the chuck is 13 inches. The approximate consumption is 400 watts.



Universal Electric Drills Operating on Direct or Alternating Current Are Constructed in Several Sizes.

It is designed for 110 or 220 volts. High grade material and workmanship are emphasized with the products of the Chicago Pneumatic Tool Company.

CORRESPONDENCE WITH THE READER.

Starting on Kerosene.

(34)—I notice considerable talk about kerosene replacing gasoline for trucks and being an owner am naturally interested. As I understand it kerosene may be used, but there is considerable trouble in starting on it. Can a motor be started cold with kerosene only as a fuel and without using heat to secure the desired vaporization? MOTOR TRUCK READER.
Boston, May 28.

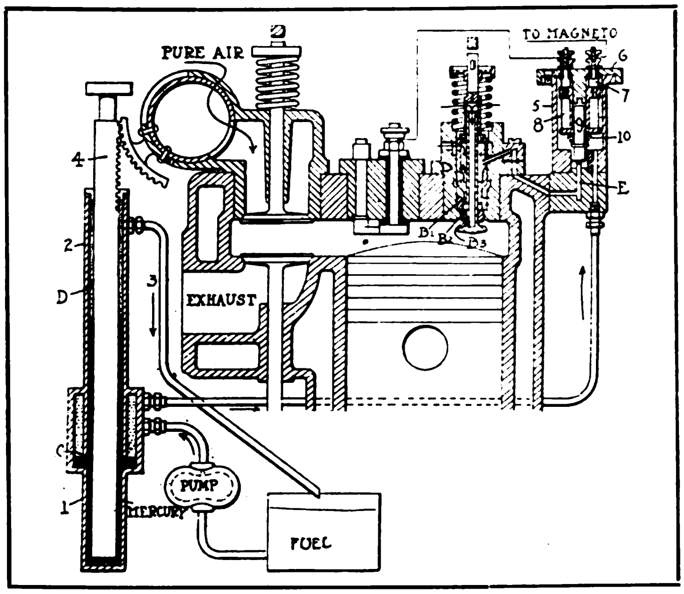


Fig. 1—General Plan of Bellem Heavy Fuel Motor, Utilizing Distributor and Magnetic Coil—The Feature of the Invention Is Pulverization of the Fuel by Injecting It into Vacuum.

Announcement was made recently of a four-cycle motor, the invention of M. Bellem, a French engineer, which is claimed to start as easily on heavy fuels, including crude oils and kerosene, as does the conventional motor utilizing gasoline. The usual carburetor or vaporizer is dispensed with, the fuel being pulverized by being injected into a vacuum formed by allowing the intake valve to open only after the piston has completed a certain portion of the suction stroke, and instead of admitting a mixture, pure air is allowed to flow through. The valve does not open until 30 degrees before lower dead centre and it closes about 30 degrees after lower dead centre. Both intakes and exhausts are mechanically operated, the latter having the usual timing.

The intake valve mechanism comprises two principal parts, a pressure regulator and a distributor. The pressure is controlled through varying the height of a column of mercury and the amount of pressure utilized does not affect the quantity of fuel. The distributor, the opening of which is independent of motor speeds, is controlled by a magnetic coil, current to which is supplied by a low-tension magneto. This electrical control renders the opening of the distributor dependent upon the weight of a needle valve and the strength of a spring.

The intake valve is of the automatic type and is in combination with the pulverizer. With the main valves closed there is considerable depression in the cylinder during the first part of the intake stroke. The automatic valve shown at Fig. 2 B is opened by the suction of the piston. The charge of fuel is brought up the valve under pressure. At the same time a certain amount of air and the liquid are brought in from A and B, through the openings B 1 and B 2 respectively. Pure air is then drawn through the stem of the valve. which is hollow, and holes B 3, completely pulverizing the fuel.

The delivery of the fuel is accomplished by the pressure regulator and the distributor. The former is supplied from the tank by a pump. It comprises a metal vessel 1, containing mercury, and welded to it, a metal tube the lower end of which is level with the top of the mercury. Located in the tube is a plunger 4, capable of being raised or lowered in any convenient manner, and according to its position this varies the height of the column of mercury D in the tube 2. The pressure of the fuel in the chamber C is regulated by the column of mercury.

The overflow or excess of fuel passes through the mercury column and down an overflow pipe 3 to the tank. The feed pipe has a capacity slightly greater than that of the motor under full power. The quantity of fuel flowing through the return pipe is negligible and no mercury is carried through with the fuel. The plunger is connected to the air valve, and a single operation, controlled either by a governor or by hand, determines the pressure of the fuel to the distributor and the amount of air admitted to the motor.

A feed pipe connects the pressure chamber with the distributor at the right of the automatic valve. As the pressure is variable the distributor is not called upon to regulate the quantity of fuel as its opening must be constant and independent of motor speed. The magnetic control is shown at Fig. 2 A. It comprises a soft iron core 5, with a cover 6, to which is secured the coil 8, by means of insulated terminals 7. In the centre of the coil is a needle valve 9, which is held on its seat by a coil spring 10. At the instant of breaking contact on a low-tension magneto the needle valve

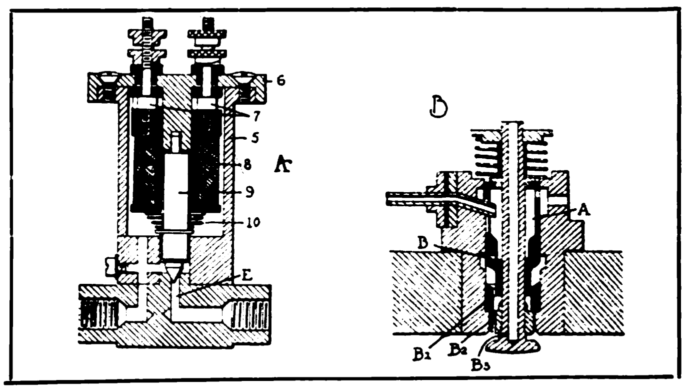


Fig. 2—Details of the Bellem Motor: A, Magnetic Control, Current to Which Is Supplied by Low-Tension Magneto; B, Automatic Valve and Ports for Fuel and Air.

is raised from its seat and the fuel under pressure in the feed pipe enters through E to the pulverizer. The opening of the valve is instantaneous and depends on the weight of the needle valve and tension of spring.

(Continued from Page 429.)

er of an electric pleasure vehicle, anyway, has so many ideas offered to him in regard to promised service that by the time he has completed his purchase he has service, guarantee and maintenance mixed up in one portion, with the firm conviction in his mind that all these things together mean—his car can be operated without cost to him, except the garage charges. I am firmly convinced that it is necessary to adopt a standard service that can be offered to the prospective buyer as a standard service, so that he may know exactly what he may expect after he puts his car in operation.

I am pleased to say, unofficially, that the Electric Automobile Manufacturers' Association have this very question of service up for discussion and hope within the next 30 days to offer to their members for adoption a standard service which will be, with possibly a few exceptions, as follows:

1. Free inspection once a month of car at garage or service station, provided it is sent to the station at the time specified by seller. 2. Charge will be made for this service unless the car is delivered at station on day agreed upon. 3. No charge will be made for examining wiring, motor, controller, brakes, steering, running gear, or an examination of the battery to determine the time for washing or its general condition, as to whether it is being properly flushed and cared for. Nor will a charge be made for oiling the entire car which, however, does not include repacking of bearings or gears in grease. 4. If inspection develops any needed repairs, due to natural wear, accidents or other causes, the owner will be notified of same and an estimate of cost for doing the work furnished. 5. This service in no way eliminates the responsibility of the garage in which the car is kept.

If this standard service is adopted by the E. A. M. A.—and I believe it will be—it will establish a precedent for the honest salesman's use and it will eventually result in an actual profit to the honest agent, for the reason that as his business grows and more cars come in for inspection each month, repairs that can legitimately be charged for will be developed more and more, until the service proposition, which is now a misnomer and a nightmare, will actually become a source of profit to the seller, as well as a source of comfort to the buyer—to say nothing of the advantage it would mean to the average salesman. There are other points regarding the service question that cannot be touched upon in this short address.

The selling proposition—It is a self-evident fact that after the quality, style and probable demands of the public are considered, as well as the selling policy of the manufacturer, the actual placing of the car after all is in the hands of the salesman. The question of the electric vehicle salesman at the present time is to my mind one that should be carefully discussed, particularly in the retail end of the electric pleasure vehicle business, and there are some things connected with the electric vehicle salesman that could, at least, be changed for the real benefit of the salesman and the employer.

I believe that this condition—so far as the salesman is concerned—could be improved through an association as powerful as the Electric Vehicle Association, particularly if the assistance of the local organizations could be obtained, and I am sure it could be.

Competition in the electric vehicle business is getting keener each year and it has by no means reached its climax, and I am of the opinion that it is absolutely necessary to correct some of the existing evils in this line of business, in order to offset the loss of profit which is brought about by the very keen competition that exists at the present time.

I believe that the Electric Vehicle Association should appoint committees to take up these questions and see that something is done to improve existing conditions.

The discussion that followed this paper concluded the evening session.

The third and concluding session was begun the following morning at 10, the first paper being on "Advertising the Electric Vehicle from the Manufacturers' Standpoint," by F. Nelson Carle, advertising manager for the General Vehicle Company, Long Island City, N. Y., who spoke as follows:

Advertising the Electric Vehicle.

From an advertising standpoint the electric truck is a much more prosaic proposition than the electric passenger car. The point of contact is very different. Each has its own field and its own appeal. The manufacturer who can enlist the interest of women readers in his product has a tremendous advantage. At the same time we are making remarkable progress in both phases of electric vehicle advertising. It should be remembered that advertising parallels the progress of an industry. It need not necessarily be crude in its early stages, but it will lack the proper objective point just as much as introductory selling does. And before I try to tell you what electric vehicle advertising has accomplished, I ought to show you how such advertising is often influenced, if not restricted, by the selling policy.

Assuming that a good electric truck, in particular, has been developed or acquired by a group of able men, there are two ways in which they can reach the goal of national distribution. One is to start with large capital and tie it up in, say, 15 branch offices until such time as the volume of business will support such a huge selling organization, and the other is to start with moderate capital and a nucleus of, say, three branch offices and expand as any old line of business on a sure foundation would. We have left the first mentioned plan largely to our gasoline truck competitors, many of whom have had for years a splendid national selling organization for their passenger cars and are marketing their trucks through the same channels. Some of us feel that the truck would better be divorced from the passenger car in selling, but perhaps that is a matter of opinion.

The motor truck owes much to the automobile, yet it has inherited some things from it which are giving the industry a lot of trouble just now, and one of these is unsound expansion. So we may congratulate ourselves I think that not only have electric truck makers taken the lead in sound design, sane speed and other fundamentals of long lived construction, but they are leaders also in sound selling. They recognize that adaptability insures operating efficiency. That permanent satisfaction for the buyer is what really counts in building for the future. Working along these lines takes patience and courage. To be consistent the manufacturer must at first follow the lines of least resistance in selling and perhaps sell the bulk of his product in given centres or to certain lines of trade. He must sell each machine at a profit and sell it only where adaptability will insure high operating efficiency. If he patiently persists in this, his back will not be broken by the free service and repair station, and his reorder business will offset the greater expense of introductory selling in new territory. Little by little he will be able to add branch offices and other units to his distributing system and grow as all business should grow—along normal and healthy lines. Not all electric vehicle manufacturers look at the selling problem in the same light, but all realize that while we may be in the automobile business, we must make money if we are to stay in the truck end of it. How to make the turnover and expand at the same time is the problem. So in view of the foregoing you can see how electric truck advertising is being influenced by selling conditions peculiar to the electric. Over these conditions we have practically no control, though they are improving from year to year. Probably very few of you realize how hard some of us are working to bring our advertising into harmony with the selling plan so that there will be no lost motion, and every dollar will count. This makes the advertising man chafe at some of the restrictions, but it is good training for him.

To reinforce intensive selling with advertising directed to the whole country not only seems expensive to most manufacturers but, viewed in the light of immediate results, wasteful as well. Perhaps this is why much of electric truck advertising is done in the newspapers of branch office cities to the neglect of other mediums. Each manufacturer does things a little differently. I have found that such advertising to be most effective must be localized. No two cities offer quite the same selling problem, and what is true of sales should be true of advertising. Educational copy written on broad lines is helpful in any city, but intensive copy adapted primarily for New York will not fit in Chicago, Boston or other cities. It will not fit because of the variation in three important factors: 1, road or traffic conditions; 2, status of the horse delivery contractor; 3, status of the electric truck. If the electric has a good foothold in a given city and is on the whole well spoken of, it is much easier to produce results from a given expenditure than it would be in a city where these conditions are reversed.

There has been a marked improvement in such newspaper advertising, and when we take our copy away from the sporting page with its golf news and prize fights and put it on the news pages there will be more. Let those who favor the automobile style of advertising for trucks consider what we are trying to accomplish with a small allowance a truck on a limited annual output, and they may deal with us more kindly. Criticisms are welcome and appreciated so long as they are constructive.

Trade paper advertising has been condemned by many, but not as a whole, I think, by those who have studied the matter carefully. There are many trades which will always be relatively non-productive for electric trucks, but there are others which have already invested heavily in them. Such trades respond to advertising when it is directed to them in the language of that trade. The mistake is too often made of running the same piece of copy in a dozen different trade papers, and that procedure deserves no results. Magazine advertising is bringing both the electric truck and electric passenger car more and more before prospective buyers, and the importance of the advertising being done by the Electric Vehicle Association of America is tremendous, especially at this stage of the industry. Such advertising has cumulative as well as educational value, and I only wish we individual manufacturers could follow the lead of the Electric Vehicle Association with page copy to a greater extent than we do. I have briefly indicated in general, why we are not in just the best position to invest largely in national advertising at the present time. It would be splendid if each large manufacturer at least could appropriate $100,000 a year for this purpose, but only a very large volume of business would warrant at this time such a long term investment. Of course we are getting there by degrees.

Central station advertising in the interest of the electric vehicle is increasing from year to year, and even though the central station doesn't spend its own money to increase electric vehicle sales, it can do a lot for the manufacturer by aiding him in the study of local conditions. For that matter, if we were to carry this spirit of co-operation to its logical end, every one interested in the success of the electric vehicle could aid in a very practical way in increasing its sales. If I were the advertising manager of an electric vehicle concern in Chicago, for example, trying to help my company open up New England territory, I would certainly consider it of prime importance to know something of local conditions. I wonder how many of you gentlemen have contributed your knowledge of local conditions to the general fund of data on New England as a mar-

ket for the electric vehicle? If you saw that my advertising failed to take into account conditions peculiar to Boston, Providence, or Worcester, would you, if you were a well posted battery man for example, try to enlighten our local representative in some way, or would you let him waste good money in trying to accomplish the impossible under the circumstances? If there is only so much available for educational work on the part of all the electric vehicle interest, doesn't all money so wasted indirectly hurt your end of the business?

About a year ago I had occasion to write a series of newspaper advertisements for a certain town, in which I hammered the shortcomings of the horse with unusual fervor. The advertising fell flat. Recently I spent two days in that city and got what I thought was a pretty good line on conditions. Just as I was about to get on the train a friend of mine asked if I knew that a certain department store was going to put in its own delivery system again. A few rapid fire questions on my part developed the fact that fully 70 per cent. of the general trucking and department store deliveries were really controlled by three contractors. The wagons bore the names of the respective stores and had fooled me nicely. Here I had been advertising to merchants of that city about the high cost of their horses when some of them had not owned a horse for five years. That is but one example of what not only we advertising men, but salesmen, are up against all over the country, and the central station executive or the local battery or tire man who will co-operate with the electric vehicle manufacturer in posting him on local conditions paves the way for intelligent local advertising. Many a salesman has wasted time and energy in endeavoring to develop electric vehicle sales in new territory with practically no results, simply because information which he should have had was not available to make his work easier. I do not say that it is not every salesman's first duty to post himself on conditions in his territory, but if some individual sincerely interested in the success of the electric of either type were to give the new man on the ground, perhaps in one hour, what it would take the newcomer six months to acquire for himself, surely here is co-operation which will ultimately pay big dividends. In this connection, no advertising man can possibly hit the nail on the head each time without help from the salesman and the central station on the ground. The branch offices of his company are relatively few in comparison with the countless local problems to be considered, so here is where the electrical interests everywhere can help the whole electric vehicle movement.

Electric truck advertising has already accomplished much more than we give it credit for. It has been believable and has inspired confidence in the storage battery vehicle. It has won men over to a point where they will at least concede the superiority of the electric in its field. Now we must educate them to see the size of that field—to see the tremendous relative volume of city trucking and intercity or other long haul trucking. Impress upon the prospective buyer the importance of adaptability as a factor in operating efficiency. Keep before him the value of simplicity in construction and operation as a factor in the labor problems. Many electric truck advantages are founded on economic laws, and when a man understands this he gets away from the all-automobile idea and into the realm of transportation machinery, and that is what we are selling. Our advertisers are not mud slingers, and that counts much in the public mind. Merchants and manufacturers are getting the impression that we are trying to build as we go instead of trying to cover the country with our product in 12 months, and that appeals to them, since it is in harmony with sound business principles. These impressions gaining in volume from day to day stamp the electric, not as something marketed in haste only to be distanced by the 1914 model, but a machine backed by a principle which is right, and so must endure.

I look forward to the day when this industry will draw to it the keenest advertising minds of the day. Men who make their work a religion rather than a pastime or means to an end. In the selling end we are slowly but surely being favored with clean cut men who are a splendid asset. They come not so much to get in on the ground floor as the industry takes a boom as because they sincerely believe in the electric principle. And we need men of this stamp in the industry, even more than we need additional capital. If we can bring our advertising up to where it will create that spirit of spontaneous confidence, not only in our product, but in our way of doing business, we shall not lack boosters. And certainly the world smiles at the man whose heart is in his work.

Advertising Electric Vehicles from Central Station Viewpoint.

The concluding paper of the convention was "Advertising the Electric Vehicle, from a Central Station Standpoint," by E. J. W. Proffitt of the Narragansett Electric Light Company, Providence, R. I. He took the position of the third in the triangle of buyer, seller and advertising man, emphasized the value of advertisement, praised the publicity campaign of the Electric Vehicle Association of America, and credited the co-operative endeavors of the different interests with much of the success thus far met with. The quality and efficiency of the electric vehicle is known and with perfected machines he believed the problems of distribution and service would be satisfactorily solved.

He included advertising with distribution. He was of the opinion that the campaign of the Electric Vehicle Association of America should have been sectional instead of national because, in his mind, the greatest field for the electric vehicle was in the eastern part of the country, and maintained that had this campaign been in part in newspapers the central stations would have been able to co-operate in it. He did not favor the electric vehicle manufacturers placing their advertising appropriations in the hands of the Electric Vehicle Association to be handled by that body, but suggested that the central stations and manufacturers supplement the publicity of the association along predetermined lines, and that this work should not be left undecided before the next campaign is inaugurated. He believed the value of supplemental advertising could not be over-estimated.

In central station advertising one of the most important factors is service, and he believed it distinctly inadvisable for the central station to advertise the electric vehicle extensively until such service shall have been provided, or else it is prepared at its own expense to supply this service. The central station cannot afford to assume the whole burden because of the limited income, and he suggested that while the central station was logically the interest to supply this service the manufacturer should allow the central station a certain sum for each vehicle sold in the territory of a given station. The manufacturer could then advertise this service, which would be a valuable factor in selling, he could furnish a guarantee that the central station could make good, eliminating all questions and doubts, and making it possible for the central station to aggressively push the business for its own and the manufacturer's gain.

Discussion of Mr. Carle's and Mr. Proffitt's papers was followed by discussion in which Mr. Bartlett described the advertising campaign carried on by the pleasure car dealers of Philadelphia.

Adjournment was taken after the papers had been referred to the executive committee to formulate plans and policies, and there had been an understanding that the central stations would send out with statements and communications to their customers such literature as might be prepared by the association, setting forth the advantages, utility and economy of electric pleasure cars and service wagons.

The delegates went to the Relay house, Bass Point, Nahant, where a ball game was engaged in by teams representing the electric vehicle manufacturers and the central station interests, but a group visited the works of the General Electric Company at West Lynn, arriving in season to see the vehicle team win by an estimated score of 24 to 23. Then came the dinner at the Relay house in the evening, with a series of one-minute speeches, at which Mr. Kimball officiated as toastmaster and time keeper.

The delegates attending the convention were the following:

F. P. Allen, Whitten-Gilmore Company, Boston; L. R. Abel, American Storage Battery Company, Boston; W. C. Anderson, Anderson Electric Car Company, Detroit, Mich.; A. H. Abbott, General Electric Company, Boston; D. E. Bent, Edison Storage Battery Company, Boston; W. H. Atkins, Edison Electric Illuminating Company, Boston; E. B. Burleigh, General Electric Company, Boston; H. W. Briggs, Edison Electric Illuminating Company, Boston; H. E. Crane, Crane Auto Garage Company, Providence, R. I.; R. Bennett, Anderson Electric Car Company, Boston; O. F. Barstow, General Electric Company, Boston; J. C. Bartlett, Woods Electric Garage Company, Philadelphia, Penn.; E. J. Bartlett, Baker Motor Vehicle Company, Cleveland, O.; J. S. Brown, Lowell Electric Company, Lowell, Mass.; E. W. M. Bailey, S. R. Bailey & Co., Amesbury, Mass.; D. W. Beaman, New Bedford Gas & Edison Electric Company, New Bedford, Mass.; William G. Bee, Edison Storage Battery Company, Orange, N. J.; J. L. Brown, Anderson Electric Car Company, Boston; K. L. Curtis, Anderson Manufacturing Company, Boston; J. W. Cook, Electric Storage Battery Company, Boston; F. Nelson Carle, General Vehicle Company, New York City; J. C. Codman, S. R. Bailey & Co., Amesbury, Mass.; C. F. Clark, Electric Vehicle Company, Worcester, Mass.; W. B. Conant, Electric Review, Brookline, Mass.; C. H. Clark, Holtzer-Cabot Electric Company, Brookline, Mass.; A. E. Carpenter, Atlantic Vehicle Company, Boston; E. Carpenter, Oak Bluffs, Mass.; T. I. Donahue, Edison Electric Illuminating Company, Boston; E. R. Davenport, Narragansett Electric Light Company, Providence, R. I.; Edmund Davis, Philadelphia Storage Battery Company, Philadelphia, Penn.; O. G. Draper, Electric Motor Car Club of Boston; L. L. Edgar, Edison Electric Illuminating Company, Boston; W. H. Francis, Edison Electric Illuminating Company, Boston; D. C. Fenner, International Motor Company, New York City; C. L. Edgar, Edison Electric Illuminating Company, Boston; M. A. Frank, Motz Tire & Rubber Company, Boston; J. J. Flynn, Standard Electric Car Company, Jackson, Mich.; Bruce Faxon, Wagner Manufacturing Company, Boston; W. J. Fitch, General Electric Company, Lynn, Mass.; E. E. Greenwood, Edison Electric Illuminating Company, Boston; Henry Goodman, Buffalo Electric Vehicle Company, Buffalo, N. Y.; J. E. Gray, Narragansett Electric Light Company, Providence, R. I.; R. C. Gregg, Philadelphia Storage Battery Company, Philadelphia, Penn.; R. S. Hale, Edison Electric Illuminating Company, Boston; W. E. Towne, Narragansett Electric Light Company, Providence, R. I.; A. H. Alcott, Narragansett Electric Light Company, Providence, R. I.; Day Baker, General Vehicle Company, Boston; B. A. Gookin, Narragansett Electric Light Company, Providence, R. I.; P. A. Gallagher, Jr., Narragansett Electric Light Company, Providence, R. I.; W. H. Angevine, Narragansett Electric Light Company, Providence, R. I.; E. D. Osgood, Buffalo Electric Company, Buffalo, N. Y.; F. B. Carter, General Vehicle Company, Boston; C. H. Hatch, Edison Electric Illuminating Company, Boston; C. J. Hatch, Edison Electric Illuminating Company, Boston; J. A. Hunnewell, Lowell Electric Light Company, Lowell, Mass.; C. E. Holmes, Cambridge Electric Light Company, Cambridge, Mass.; R. L. Holmes, Narragansett Electric Light Company, Providence, R. I.; M. M. Hammond, Anderson Electric Car Company, Boston; W. B. Jones, Webster Electric Company, Boston; E. C. Kimball, Edison Electric Illuminating Company, Boston; S. J. Kniv, Wetmore-Savage Company, Boston; H. L. Knowlton, Electrical World, Boston; F. M. Redman, General Electric Company, Boston; John Kelly, Edison Storage Battery Company, New York City; Alexander Michaud, Salem Electric Light Company, Salem, Mass.; J. McDonald, Cambridge Electric Light Company, Cambridge, Mass.; O. E. Mitchell, Narragansett Electric Light Company, Providence, R. I.; E. H. Macready, Narragansett Electric Light Company, Providence, R. I.; F. S. Marr, Philadelphia Storage Battery Company, Philadelphia, Penn.; E. S. Mansfield, Edison Electric Illuminating Company, Boston; J. C. Henderson, Woods Motor Vehicle Company, Chicago, Ill.; Converse D. Marsh, New York City; C. L. May, Boston; Ira Miller, Westfield, Mass.; J. J. Buckley, Edison Electric Illuminating Company, Boston; L. D. Gibbs, Edison Electric Illuminating Company, Boston; H. W. Moses, Edison Electric Illuminating Company, Boston; A. E. Josselyn, Edison Electric Illuminating Company, Boston; R. C. Norton, Baker Motor Vehicle Company, Cleveland, O.; F. R. Newell, Worcester Electric Light Company, Worcester, Mass.; A. F. Neale, Waverley Company, Boston; D. B. Neth, Connecticut Company, Waterbury, Conn.; A. F. Nelson, Edison Electric Illuminating Company of Brockton, Brockton, Mass.; E. N. Norris, Edison Electric Illuminating Company, Boston; C. E. Page, Malden & Melrose Gas Light Company, Malden, Mass.; Edward J. W. Proffitt, Narragansett Electric Light Company, Providence, R. I.; F. N. Phelps, Baker Motor Vehicle Company, Boston; L. P. Perry, Narragansett Electric Light Company, Providence, R. I.; T. M. Pike, National Carbon Company, Cleveland, O.; A. D. Putman, Worcester Electric Vehicle Company, Worcester, Mass.; C. C. Pilsbury, Westinghouse Electric & Manufacturing Company, Boston; J. C. Patterson, Anderson Electric Company, Needham, Mass.; E. Phaneuf, Electric Machine & Instrument Company, Boston; C. A. Perry, D. C. Tiffany Company, Boston; N. Rommelfanger, Boston; F. S. Rogers, Waverley Company, New York City; R. W. Rollins, Worcester Electric Light Company, Worcester, Mass.; A. H. Robbins, Electric Light & Power Company of Arlington and Rockland, North Arlington, Mass.; Harvey Robinson, secretary of the Electric Vehicle Association of America, New York City; E. A. Shanahan, General Electric Company, Lynn, Mass.; S. F. Smith, Salem Electric Light Company, Salem, Mass.; Frank J. Stone, Electric Storage Battery Company, Boston; C. D. Stanford, Atlantic Vehicle Company, Boston; Ralph Sanger, Atlantic Vehicle Company, New York City; F. E. Sawyer, Salem Electric Light Company, Salem, Mass.; H. H. Skinner, Narragansett Electric Light Company, Providence, R. I.; F. H. Smith, Worcester Electric Light Company, Worcester, Mass.; J. W. Sanger, Atlantic Vehicle Company, Boston; J. E. Spike, Cambridge Electric Light Company, Cambridge, Mass.; H. E. Taylor, Lansden Company of New England, Boston; F. T. Taylor, Cutler-Hammer Manufacturing Company, Boston; Willis M. Thayer, Hartford Electric Light Company, Hartford, Conn.; T. J. Toohey, Narragansett Electric Light Company, Providence, R. I.; H. F. Thomson, Massachusetts Institute of Technology, Boston; H. H. Van Stranzer, Westinghouse Electric & Manufacturing Company, Boston; L. Vredenburgh, Edison Electric Illuminating Company, Boston; J. E. Whiting, Edison Electric Illuminating Company, Boston; C. A. White, Edison Electric Illuminating Company, Boston; E. E. Wallace, General Vehicle Company, Boston; J. West, Jenney Company, Boston; Adamson Battery Company, Boston; A. Weatherby, Anderson Electric Car Company, Boston; E. J. Wood, Narragansett Electric Light Company, Providence, R. I.; L. R. Wallis, Edison Electric Illuminating Company, Boston; P. E. Whiting, S. R. Bailey & Co., Amesbury, Mass.; Harrison W. Wagner, Consolidated Gas Electric Light & Power Company, Baltimore, Md.; George D. Baxter, Haverhill Electric Company, Haverhill, Mass.; F. R. Ball, Haverhill Electric Company, Haverhill, Mass.; R. C. Batting, Batting Coal Company, Malden, Mass.; Henry Clark, Winchester Suburban Gas Company, Winchester, Mass.; G. W. Ellis, Boston; P. A. Gallagher, Narragansett Electric Light Company, Providence, R. I.; F. S. Gassaway, Willard Storage Battery Company, New York City; P. H. Johnson, Cutler-Hammer Manufacturing Company, Boston; H. Kingsley, Salem Electric Light Company, Salem, Mass.; R. C. Newcomb, Blackstone Valley Gas & Electric Company, Woonsocket, R. I.; F. T. Sanderson, North Abington Electric Light and Gas Company, North Abington, Mass.; W. H. Snow, New Bedford Edison Company, New Bedford, Mass.; Thomas Toomey, Narragansett Electric Light Company, Providence, R. I.; F. W. Trickey, B. F. Goodrich Company, Boston.

LEAVES INTERNATIONAL MOTOR.

Well Known Writer on Motor Truck Subjects Retires as Advertising and Publicity Manager.

Rollin W. Hutchinson, Jr., advertising manager of the International Motor Company, New York City, maker of Mack, Saurer and Hewitt trucks, has resigned his position, which took effect June 1. Mr. Hutchinson has had charge of the advertising and publicity of the International company and its predecessor, the Saurer Motor Company, since their establishment, and has acquired a unique and comprehensive knowledge of motor truck subjects and the attitude of business interests toward them.

Being a graduate engineer and a student of mechanical sciences, his view of the motor industry has been especially intelligent and comprehensive and his articles on trucking subjects and traffic economies have given him a national reputation as a writer and student of these topics. As a producer of genuinely educational publicity he has been prolific and distinguished.

QUICK CLIMBING WITH KELLY.

California Owner Hauls Load of Provisions to Lick Observatory Over Mt. Hamilton Road.

Louis Normandin of the Normandin-Campen Company of San Jose, Cal., recently made a run with a oneton Kelly truck, made by the Kelly-Springfield Motor Truck Company, Springfield, O., loaded to capacity with fruit, provisions, etc., from the centre of the city to Lick Observatory on Mt. Hamilton in 2:45:00.

The run was made over the regular Mt. Hamilton road, which was found to be in good condition, but considering the steep grades the time made by the truck was exceptional. The return trip was made in 2:05:00 and no adjustments were found to be necessary during the journey.

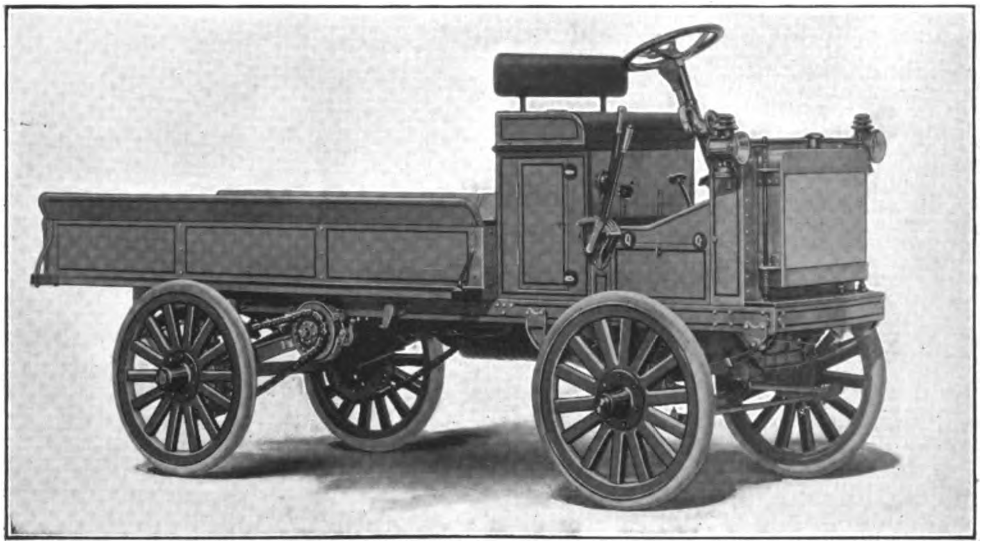
SANFORD 3000-POUND MODEL L WAGON.

THE model L delivery wagon built by the Sanford Motor Truck Company, Syracuse, N. Y., has 3000 pounds capacity and it is a standardized production. It was developed to meet a demand for a machine of larger capacity than the model K, a 2000-pound wagon, and aside from proportions it is identical with the smaller. The Sanford wagons are the development from nine years' experience, and the maker maintains that they embody every desirable quality that makes for strength, endurance, efficiency and minimum maintenance and operating expense.

The power plant is a unit, the motor, clutch and transmission gearset being assembled together. The motor is a four-cycle, four-cylinder, water-cooled, L head type with the cylinders cast in pairs. The engine has a bore of four inches and stroke of 4.5 inches, this giving 25.6 horsepower by the S. A. E. rating. The valves are at the left side of the motor and the stems, springs, tappets and guides are protected by cover plates that may be easily removed. The crankcase is a barrel type with a base inclined forward so as to insure sufficient lubrication while the machine may be ascending a grade. A large extension of the rear of the case houses the flywheel and clutch, and to this is bolted the housing of the transmission gearset. There is a long side plate at the left of the engine case and two plates at the right, which may be removed for work or examination of the motor shafts or bearings. Two other plates afford access to the clutch and gearset cases. The timing gears are housed by a forward extension of the crankcase and a cover plate. The gears drive the camshaft and an outside shaft that drives the centrifugal water pump and the magneto, the latter being carried on a bracket.

The lubrication is by a combination force feed and splash system, the oil being drawn from a two gallons capacity reservoir in the base of the crankcase by a pump driven off the camshaft, and being filtered before it is circulated. The motor is cooled by a circulation of water through a large radiator and the water jackets by a centrifugal pump, and radiation is promoted by a four-bladed fan mounted on an adjustable bracket on the forward cylinder unit, driven by a flat belt from a pulley on the crankshaft extension. The carburetor is an automatic float feed type that supplies a uniform mixture at all engine speeds. The motor is governed by a governor driven by the outside shaft and connected with the fuel intake that is contained in a case that can be sealed so that it cannot be changed by the driver. The ignition is by a high-tension magneto.

The clutch is a multiple disc construction, which is made with 16 crucible steel plates, hardened, tempered and ground, which is oiled by the same system that lubricates the engine. The transmission gearset is a selective type, having three forward speeds and reverse, the shafts being of large diameter and mounted on annular ball bearings, and the gears are wide faced and of general proportions. An interlocking device prevents more than one set of gears meshing at one time. The transmission shaft is a special work, being drop forged from special analysis steel, hardened, heat and ground. The power plant is carried in the frame supported at three points. The drive is to the jackshaft by shaft, and then by chains to the rear wheel hubs.



The Sanford Model L Delivery Wagon, Capacity 1.5 Tons, the Latest Product of the Sanford Motor Truck Company, Syracuse, N. Y.

The frame is a steel channel section five inches width and of liberal depth, with heavy and well reinforced cross members, the front member being shaped to form a bumper to protect the radiator. The frame is supported by semi-elliptic springs 2.5 inches width forward and a platform construction at the rear. The forward axle is an I section three inches by 1.875 inches, the rear axle is a heavy rectangular section, both of which are fitted with roller bearings. The wheels are 36 inches diameter with 3.5-inch tires forward and four-inch tires rear. The wheelbase is 118 inches. The drive is right side, with right hand speed changing and emergency brake levers, and with spark and throttle levers on the steering wheel. The clutch and service brake are controlled by pedals. The service brake shoes operate with contracting bands on drums on the jackshaft and the emergency brake shoes are external contracting on drums on the rear wheels. Both brakes are fitted with equalizers. The chassis are fitted with standard type bodies and with the usual lamp, horn and tool equipment.

ELECTRIC POWER WAGONS AT PITTSBURG.

THE following letter has been received by MOTOR TRUCK, and the facts set forth are of material interest to all who are concerned in power wagon transportation. The writer has had opportunity to observe and investigate conditions and his conclusions are based upon fact:

Editor, Motor Truck:—

"Where Are the Electric Vehicles?" is the title of an article published in a recent issue of a magazine devoted to power wagons, and the query in the caption should seemingly be accompanied by a statement of fact, but even casual examination will demonstrate many errors, though probably written from what was assumed to be reasonably correct information. For instance, Boston is credited with 130 electric vehicles, when there were 279 in that city Jan. 1, 1913. Pittsburg is given but one or two machines of this type, the source of information is stated to be the Allegheny County Light Company, and the reason for so few a number is claimed to be "the hills." These statements are wrong. The Allegheny County Light Company gave merely the number of its own machines, but not the total in use in Pittsburg. There are 19 vehicles used commercially and seven industrial trucks in operation in the city.

That electric vehicles are not more numerous in Pittsburg is not because of the hills, for actual demonstration has proven capacity, but is due to the fact that those now in use are from seven to 10 years old, are very crude as compared with machines now produced, and these are seldom, if ever, maintained so as to obtain anything like a reasonable work. That Pittsburg is a "poor town" for electrics may be met by the statement that the people are living in a very dim past so far as these machines are concerned. The vehicles are old and in every respect cannot be compared with those regarded as standard productions. Yet, McCreery & Co.'s seven-year-old wagon is frequently driven 45 miles on a single charge, and one of the officials of the company is authority for the statement that this machine is operated at a saving of 40 per cent. as compared with any other type of vehicle. The five-ton Vehicle Equipment truck of the Bindley Hardware Company has covered 28 miles to a charge over the streets of Pittsburg, up and down the hills as they are met, and this machine is nearly 10 years old.

Considering the work done with the electrics, and making comparison with any other type of vehicle, it will be admitted that the results are surprising. Here is an example: A large Pittsburg concern installed two 3.5-ton trucks seven or eight years ago. The engineer of the plant has charge of these when in the garage. This engineer and his company today condemn all electrics, but here are the facts: The engineer states that the battery of each truck weighed 850 pounds and was rated at 10 horsepower and that the motor was rated at 10 horsepower. No battery has a rating of weight or horsepower, but to accept this and taking a 850-pound battery as the basis—the lead battery of a 1000-pound delivery wagon today weighs from 1100 to 1300 pounds and the lead battery of a 3.5-ton truck 2700 to 2900 pounds, but this truck was designed to carry 7000 pounds, and the battery was ridiculously small. It could not have adequate power. The motor was 10 horsepower. In proportion to the size of the battery a two horsepower motor would have been very large, but this machine was equipped with a battery less than a third of the size now used and with a motor more than twice the size now installed in 3.5-ton trucks. The result was that the motor wasted current taken from the small battery, the energy was rapidly exhausted and there was no power available for any length of time. A 10 horsepower motor would be suited for an eight-ton truck, but one of 3.5 or four horsepower would be sufficient for a machine such as was used, for the motor can be given a temporary overload of 300 per cent. if necessary to climb a hill, go through sand or pass over a rough road. One of the economies of an electric machine is the small power needed for good roads and the possibility of increasing this from a four to a 16 horsepower in the event of need.

With this strangely proportioned equipment, the small battery and the big motor, this truck was driven from 10 to 12 miles on a battery charge, though no one knows whether the battery was properly charged. Should one take a 3.5-ton gasoline chassis and install a motor suited for a 1000-pound wagon and a driving system built for an eight-ton truck, and endeavor to carry 3.5 tons of load, it is probable the machine would hardly move the load. But the electric truck carried its freights surprising distances considering the construction.

About three years ago a wholesale liquor dealer bought a 1.5-ton electric wagon that had been used for four years. In less than a year the machine was condemned. As a matter of fact the battery was charged at the shop of the owner morning, noon and night, whenever it was not driven, sometimes an hour, sometimes more and sometimes less; the ampere rate of charging was unknown and the battery was never given a full charge, possibly not a half charge, and certainly not an over-charge, as should be given each alternate week. With a battery charged in this manner no machine could be driven on hills or on the level, but the owner attributed the seeming lack of capacity to the wagon and did not consider his own ignorance or the absence of management.

In practically every instance where electric vehicles have not given satisfaction in Pittsburg the cause can probably be traced as have those stated. But it is certain enough that the machine built by a reputable manufacturer will climb hills, carry its load and give excellent mileage, but where there is a shortcoming it is the limited mileage and the slower speed, so far as Pittsburg is concerned, for the topographical conditions are unusual. Pittsburg may be likened to a human hand with the four fingers and thumb stretched wide apart, these being taken as the principal thoroughfares extending from a base from west to east, with ridges having grades of from 40 to 90 per cent. between these main ways of traffic. Save a few downtown cross streets there are no highways connecting these five highways. While an air line between two points may be a mile or less, it is necessary for delivery to be made around the hills, often necessitating a drive of from four to eight miles. This condition makes it necessary to do a greater proportion of haulage to do a given work than is required in almost any other community. For this reason speed regarded as essential in Pittsburg and the absence of cross streets is a decided handicap to the slower moving electric, yet there are numerous instances where circuits can be made instead of returning over streets once traversed. The electric vehicle can be utilized to good advantage in Pittsburg if the owner and driver would study its possibilities.

Very truly yours,

WILLIAM KIENER.

Pittsburg, Penn., May 26.

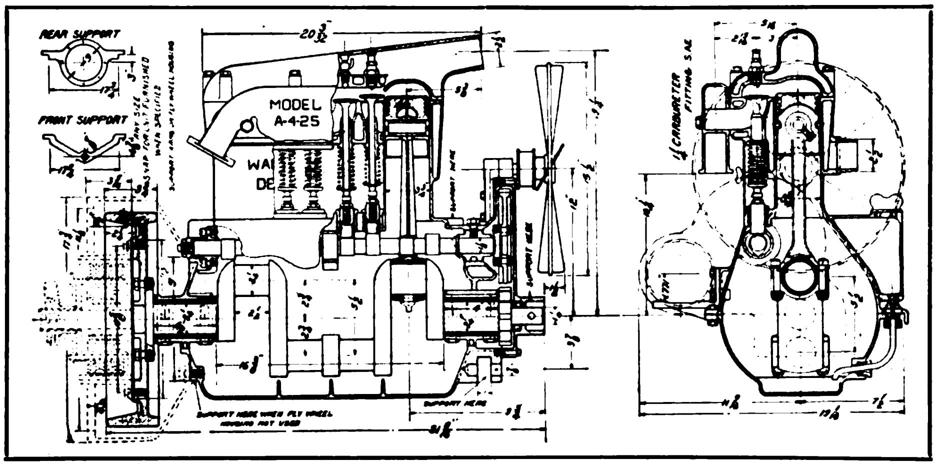
The Rand-Morrison Manufacturing Company has purchased 10 acres of land at East Boston, Mass., on the Boston & Albany railroad, and will erect there a plate shop, erection shop, machine shop, power plant, pattern shop, foundries and general offices. Contracts have been made with McClintic-Marshall Construction Company of Pittsburg, Penn., for the machine and erection shops, to Levering & Garrigues Company of Dunnellon, N. J., for the plate shop, to the New England Foundation Company for the foundations, and to the Shaw Electric Company for the electric cranes. The shops will be completed by July 1, it is expected. They will be equipped with four 10-ton and one 25-ton electric cranes. The company makes a specialty of coal handling machinery and steam and electric hoists and contracts to erect and equip the largest docks for the handling of coal in all parts of the world. The works when completed will employ 1000 men. There are now orders on hand for at least one year's production. The officers of the company are: President, Gov. Eugene N. Foss, Boston, Mass.; vice president and general manager, Willard S. Martin, Cambridge, Mass.; treasurer, John G. Morrison, Cambridge, Mass.; and the directors include those named and William J. Hoyt, Manchester, N. H.; Frank P. Carpenter, Manchester, N. H.; Burton L. Gale, Melrose, Mass., and Arthur P. French, Boston, Mass.

By the use of a Kelly one-ton delivery wagon the Coca Cola Bottling Company, Rome, Ga., has, according to Manager F. S. Biron, saved $50 weekly. This economy is in the hotel bills for drivers and the stable bills for horses, as well as having the use of the machine when it is needed. Before the wagon was purchased two wagons and teams were used, and two drivers, but now one man handles the machine. The other bills are unnecessary because every haul can be made in less than a day, but with the horses it was necessary to pay hotel and stable expenses for two or three nights each week.

WARNER-DETROIT MOTORS.

Company Formed to Build Power Plants for Passenger and Freight Vehicles.

The Warner-Detroit Motor Works is the name of a company organized at Detroit, Mich., to manufacture engines for passenger and freight vehicles, from designs by H. L. Warner. The first motor has been produced and is known as model A-4-25. It is an L head type and is unusual in that it has a bore of 3.1875 inches and stroke of 5.5 inches, the bore to stroke ratio being 1:1.72. The motor is rated at 16.2 by the S. A. E. horsepower formula, but it is claimed by the maker that it will develop nearly twice that power. The motor is a block type with the cylinders and upper half of the crankcase integral, and the oil reservoir is formed at the left side of the upper part of the case. The entire head of the motor is removable, permitting easy access to the cylinders and valves. The water spaces are large and the circulating fluid is carried to the bottoms of the expansion chambers.



Sectional Drawings Showing the Construction of the Warner-Detroit Model A-4-25 Motor.

The cylinders and pistons are of semi-steel and this affords a very light, but strong construction. The upper half of the engine case carries the crankshaft and camshaft bearings. The crankshaft is a two-bearing type, being 2.25 inches diameter. The front main bearing is four inches length, and the rear main bearing 4.5 inches length. The pistons are each fitted with four rings, three above and one at the ends of the wristpin, and the wristpins oscillate in the piston bosses. The camshaft is 1.125 inches diameter. The magneto shaft is one inch diameter. The connecting rods are channel section, of unusual length and very light. The small ends are clamped by a bolt, and the big end bearings are retained by two clamping bolts.

The timing gears are .875-inch face. The cams of the valve mechanism are one-inch face. The valves are with ports 1.5 inches, and the valve heads are cast iron electrically welded to nickel steel stems. The tappet rods are fitted with adjusting screws and lock nuts and operate within guides carried in the engine case. The valve springs are long and well tempered. The valve mechanism is protected by plates retained by wing nuts that cover the pockets in which the valve rods operate.

The lubrication is a vacuum-gravity system, the oil flowing from a reservoir in the upper half of the crankcase through a tube to the base of the engine case. So long as the lower end of the tube is below the surface of the oil no lubricant will flow, but when the level falls air will be admitted to the tube and the flow will continue until the level is reached and the tube end submerged. In the base of the engine are low baffle plates, and there are drains through these so that the level of the oil may be equalized. The motor is cooled by the thermo-syphon system, and radiation is promoted by a large fan driven by a belt from a pulley on an extension of the magneto shaft. The water inlet and outlet are made to take 2.5-inch hose for radiator connections. The flywheel is machined for the installation of a cone or a multiple disc clutch, and the case is adapted for fitting any bell housing of a transmission gearset. Brackets allow the fitting of any magneto or lighting and starting installation. The motor is built for hard work, it is short, compact, and all the parts are well made. The crankshaft and camshaft are 3.5 per cent. nickel steel, carefully heat treated.

The company proposes to produce about Aug. 1 a six-cylinder motor, with the cylinders cast en bloc, which will have the general characteristics of the engine that has been outlined. The company will also produce a sliding gear transmission having three forward speeds and reverse, with multiple disc clutch and levers for use with either type of motor it will build. H. L. Warner, founder of the Warner Gear Company and the Muncie Gear Works of Muncie, Ind., who recently disposed of his interests in the Warner Gear Company, is general manager of the company. With him is associated as general superintendent W. H. Lonsdale, for several years superintendent of the Knox Automobile Company and a mechanical engineer of long experience, and W. H. Downes, formerly of the Chas. A. Strellinger Company, as secretary.

E. W. Lyle, for a considerable length of time with the Alden Sampson department of the United States Motor Company, has been engaged by the Adams Bros. Company, Findlay, O., as superintendent.

The business of the Victor Motor Truck Company, Buffalo, N. Y., is now being conducted by the receiver, Marc W. Comstock, and it is expected that the affairs of the concern will be adjusted satisfactorily.

Alfred Pick & Co., Chicago, Ill., has purchased 10 Bessemer delivery wagons of one ton capacity.

WHOLESALE GROCERY DELIVERY BY TRUCK.

Louisville Concern Makes Experiment with a Kelly Demonstrator and Finds Decided Economy, Though Machine Is Not Worked to Its Greatest Capacity.

By G. D. Crain, Jr.

THE cost of delivery is relatively more with the small equipment than with the larger, and this is a very potent reason why there should be maximum economy sought by those who have services that may be included in the former classification. It is entirely practical for the concern of large resources to make a change in its distributing methods and to invest a considerable amount, while with those doing a smaller volume of business it may be essential to have the entire capital available. Where distribution is confined to a definite section the cost is less than were it a larger area, and it often follows that a delivery may be in a community where the distances are considerable and the cost of haulage is correspondingly high.

The owner of the business that requires several wagons may be convinced of the possibilities with motor vehicles and yet not willing to make a change because of the uncertainty of results in the conditions in which the work is done. It is a fact that the limitations of animal haulage are not always realized until after experience with motor wagons, and the failure to develop the most certain and logical economies is often due to an unwillingness to make changes that seem radical, but are abundantly justified.

Three-Ton Kelly Truck in the Service of Kentucky Grocery Company, Louisville, Ky.

An illustration of the value of the single truck is the experience of the Kentucky Grocery Company, Louisville, Ky., which has a wholesale establishment and customers throughout the city and its suburbs that must be served by road vehicles and business elsewhere that can be supplied by freight and express. Within the radius of Louisville and the suburban districts delivery has been at all times a problem, for the hauls vary from five miles in one direction to 10 in another, and with streets and highways not always good, especially in the winter and spring, and with extreme heat in summer, animals are necessarily hard worked.

While it is a fact that humanitarian considerations would have prompted using animals with care so far as loads and distances were concerned, yet it is certain that economy demanded that the delivery should be made with as great speed as possible and the loads be as heavy as could be hauled. One of the longest hauls made in the city delivery is to South Louisville, a prosperous and thickly populated community, where a full load was delivered with horses once a week. From the warehouse to the customer the distance is approximately 12 miles, the total distance for the animals to travel being close to 25 miles.

A delivery made to this suburb required a two-horse team and wagon and with a start made early in the morning practically all of the day was necessary, for the outward trip could not be driven fast, and the horses were not forced returning. Officers of the company say that in hot weather it was not unusual for the team making this delivery to be until 11 in the evening on the road. The increase of the business meant more frequent deliveries or heavier loads, and it was realized that the patronage of the customers depended upon their receiving their orders as quickly as possible. After carefully studying the conditions and the limitations of horses, and estimating the possibilities for business promotion, the officers of the company investigated the merits of motor trucks.

Power wagons were used in Louisville by a number of companies in the haulage of furniture, whiskey, beer, structural steel, plumbing fixtures and supplies, and differing merchandise, but after careful observation it was by no means a certainty that a truck would give the company the results desired, for it was believed that one machine ought to do all of the long hauls and a considerable part of the city deliveries. Though the officers of the company were willing to work out the problem and judge from actual work accomplished they were not confident that the motor truck would be as productive as was hoped for, and they concluded that they would gain their experience as cheaply as was practical. So instead of buying a new machine they purchased a Kelly truck that had

been used for nearly three years by Killgore & Stilz, the Louisville agent for that make of vehicle. Worked as a demonstrator the truck had not been spared, but it had been well maintained and was in excellent condition when it was transferred to the grocery concern.

The company had used three two-horse wagons to the time the truck was acquired, and believing that the machine would take the place of two of these, four horses and two wagons were disposed of. The two drivers of these wagons were made the crew of the truck after they had been given such instruction as in the judgment of the agent for the maker was necessary to qualify them to operate it. The first thought might have been the saving of one man's wages, but the main object was expediting the loading and unloading of the machine, that the standing or idle time might be minimized. The problem as seen by the owners was economizing in wages or in the usefulness of the machine, and as they wanted the work without any question they decided to get the fullest use of the truck.

Just what the company had with which to begin its experimental work may be interesting. There are those who will maintain that a truck that had been used three years is not a wise investment, but the machine had been well kept up mechanically, and in the service of the agent it had not been neglected. Experiment with tires had been begun by the agent, and when the truck was sold it had three Hartford and one Kelly-Springfield block tires, the latter being on a rear wheel. These were 36 by four-inch shoes. The price paid for the truck was $1820.

Beginning July 1, 1912, when the machine was transferred, the company kept a very accurate record of the work accomplished and the expense of operating, and this has been supervised by Robert E. Adams, the president, who says that his purpose was to learn precisely the cost as compared with animal service and to compare the relative work and determine efficiency from a cost as well as a service viewpoint. In this account the truck was placed against the two two-horse wagons that it replaced.

The company had carried four horses in its inventory at $150 each, though their cost was greater than this and they could have been sold for more than that figure. The total value was $600 for the animals and the wagons were estimated at $200 each and the two sets of double harness at $35 a set, making the total valuation $1070. The truck cost $750 more than this amount and at interest of six per cent. this made a monthly charge of $3.75 additional against the truck.

At the expiration of 31 weeks, or practically the end of the winter, the cost of the truck was found to be as follows:

Wages of two men	$620.00
Fuel and oil	169.73
Repairs, including new lamps, etc	316.55
Total	$1106.28

This was an average of $158.04 a month for seven months.

The cost of the wagons for a similar period was as follows:

Wages of two men	$620.00
Horse board at $17 a head a month	476.00
Horse shoeing at $11.20 a month	78.40
Wagon repairs at $5 a month each	70.00
Total	$1244.40

This gave an average of $177.77 a month.

This showed $137.12 total in favor of the truck for the period stated, or an average of $19.75 a month, and deducting from this the interest charge of $3.75 a month this made the net saving $15.98. But as a matter of fact this does not represent the full value of the machine, for with it more work is done than with the horse wagons and the possibilities with it are by no means reached.

In the matter of depreciation no charge has been made against either the truck or the horse equipment, and while it may be maintained that the repair bills for the machine were larger than might have been expected with a new vehicle, it is also certain that there would be relatively a considerable item charged against this account for the animals and the wagons. The wagon repairs are averaged at $5 a month for each, which is really very low when it is understood that bills for $90 for repairing the remaining wagon were recently received by the company. Another item not included is the loss through sickness or incapacity of horses. To illustrate: Another concern in the same business lost a horse that fell dead on returning from a hard haul with a heavy suburban load. Another horse developed a corn and for six months was idle in a stable at an expense of $16 a month, and was later pastured at $5 a month for three months, after which it was sold for $25. The veterinary's bill was $75.

In February one of the Hartford tires was replaced at a cost of $125, but the new shoe is guaranteed for 10,000 miles, and when the mile cost is considered this item is comparatively small. The mileage of the truck has not been fully kept because the odometer was not operative a part of one month from the necessity for repairing a gear connection, but as no record was made of the horse wagon this datum would not be useful for comparison were it complete.

The main result is this: That the company has found that a truck can be operated at least as cheaply as two two-horse wagons, without reducing the number of men employed, and not only is the work more quickly and better done, but there is a large reserve that is always available. Not only this, there is the satisfaction from a more expeditious delivery, which is a large factor in retaining patronage. From the viewpoint of the company the experiment has demonstrated the efficiency of the truck beyond all question.

The Haney Fire Fighting Apparatus Company, Stockton, Cal., through its president, Edward H. Haney, and its general manager, Edward Olds, announces its proposed removal to Tampa, Fla., where it will manufacture fire fighting apparatus and motor trucks. The company, which is incorporated for $2,000,000, is said to have purchased 31 acres of land southwest of Tampa and has contracted to build a plant at a cost of $50,000.

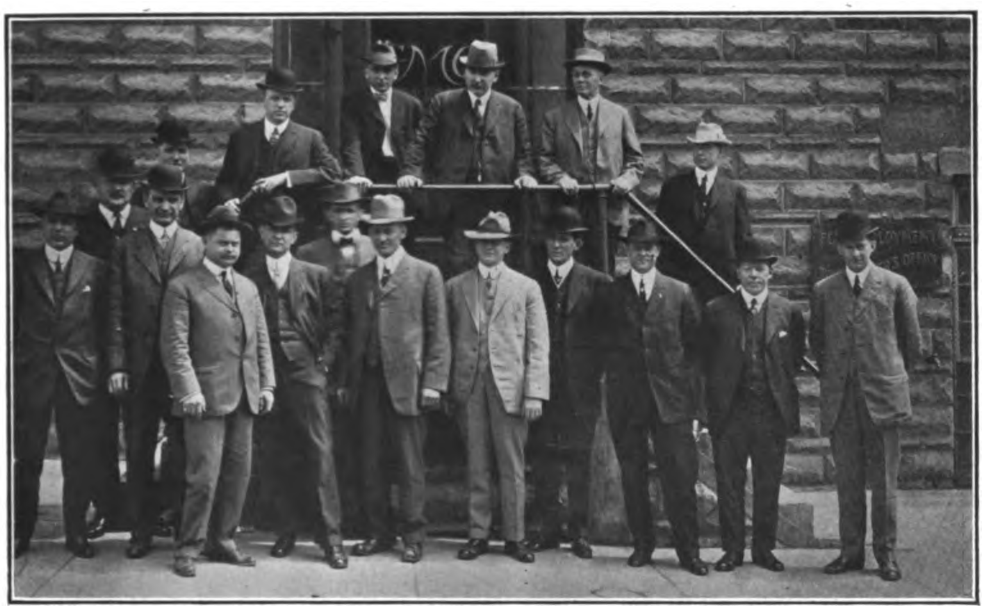
G. M. C. SALES CONVENTION.

First Annual Gathering of District Managers and Executives at Pontiac, Mich.

The first annual convention of the district managers and executives of the General Motors Truck Company took place at the factory of the company at Pontiac, Mich., May 27-29, inclusive, and was attended by something more than a score of men. The purpose of the gathering was to consider the marketing conditions as seen in different sections of the country, and to adapt the methods and policies so far as was possible for the purpose of promoting business and service.

Among those in attendance were Charles D. Warren, New York City; J. L. Morris, Boston, Mass.; J. C. Ayers, Detroit, Mich.; E. J. Kilborn, Chicago, Ill.; Estel Scott, Kansas City, Mo.; N. A. Neil, Omaha, Neb. The first day of the convention the company was addressed by President Charles W. Nash of the General Motors Truck Company, and at the other sessions the gathering was in charge of Vice President W. L. Day and Sales Manager W. L. Chilcoot.

The convention was productive of material benefit, according to the officials of the company, in that the exchange of views and experience of the different managers more closely harmonized the organization and brought about a thorough understanding of the demands of the public, as well as harmonizing endeavors along well defined lines. Not only this, but it brought about the adoption of plans that will extend and improve the service of the company.



The District Managers and Executives of the General Motors Truck Company in Convention at Pontiac, Mich., May 27-29.

MACK MERGES COMPANIES.

The Webb, Maccarr and Lansden Concerns Consolidate at Allentown, Penn.

The Webb and Maccarr companies of Allentown, Penn., and the Lansden Company of Newark, N. J., have been consolidated and the Lansden factory will be removed to Allentown. In fact a considerable part of the machinery has already been moved and as soon as it is installed in the Allentown plant activities will be resumed.

The control of the Webb company was acquired by John M. Mack, who was the active spirit in the Mack Bros. Motor Car Company, and who founded that concern at Allentown. When the Mack company was merged with the Saurer and the Hewitt companies as the International Motor Company, Mr. Mack was prominent in the affairs of that organization. He retired last year and purchased control of the Webb Motor Fire Apparatus Company of St. Louis, Mo., removed it to Allentown and changed the name to the Webb company.

Late in the autumn the Maccarr company was organized to build delivery wagons by Mr. Mack, who had associated with him a number of friends. The first machines were shown at the New York and Boston shows. A short time ago W. L. Case, who had been general manager of the Lansden Company for something more than a year, retired. Mr. Mack had acquired a large interest in the Lansden company and the announcement of the merger and the removal of the Lansden plant is no surprise to those who are familiar with the recent changes. No announcement has yet been made as to the name of the concern, or whether the companies will have nominally separate existence or will be operated as divisions.

The Webb company manufactures fire apparatus of every type, both gasoline and electric equipment, having the right to use the Couple-Gear gasoline-electric and the electric battery construction and the Couple-Gear wheels for the electric wagons and trucks. The Maccarr company has produced two types of delivery wagon, having 1500 and 2000 pounds capacity. The Lansden company builds electric wagons and trucks from 1000 pounds to five tons capacities. The supposition is that the products of each concern will be continued without change and that the selling organization will be considerably extended.

The advertising manager of the motor truck division of the American Locomotive Company, L. A. Van Patten, retired from that position June 1 and has associated himself with Harry S. Haupt, Inc., the New York agent for Lozier cars.

VEHICLE RESEARCH DATA.

Bulletin No. 3 of the Transportation Investigation of the M. I. T.

Vehicle Research Bulletin No. 3 has been issued by the electrical engineering department of the Massachusetts Institute of Technology, Boston, Mass., and it has been prepared by Prof. Harold Pender and H. F. Thomson under the title of "Observations on Horse and Motor Trucking." This compilation is necessarily condensed and it is not possible to give the conditions of service, but many facts are presented that will be found factors in practically every problem that may be considered. For instance, there is the bearing of the human element, the mental attitude of the driver, the conditions of trucking, the importance of standing time, the short and long hauls, the routing of the wagons, the mileage factor, the load factor and the delivery of freight; but there are other conditions that are not shown, such as the topography of the locality, the wages paid, the cost of fuel and power, the overhead expense, the character of administration, the influence of traffic and traffic regulations, varying restrictions, the forms of streets and highways traversed, and other items that have material bearing.

The cities in which data have been obtained include New York, Chicago, Philadelphia, St. Louis, Boston, Detroit, Washington and others of less population. The information has been widely varying in character, some of it being from systems that are comprehensive and accurate, and in other instances simple methods have been devised for obtaining some of the more important detail, it being understood that the records would be supplied the investigators as they were accumulated. In every instance, however, the facts desired were given in confidence, and with the understanding that they were not to be used for advertising purposes. For these reasons the identities of the sources of information have not been disclosed.

With the data available the study has been directed toward analyses of the work accomplished with the different vehicles, but the information is by no means sufficient to justify conclusions, especially with reference to animal wagons. The observation of registers of work, which was carried on with the vehicles of nine Boston firms, covered 63 different machines and wagons, ranging from one to three-horse teams and from 700 to 10,000 pounds capacity motor trucks. The observation continued from two to eight months' work with each. In all something more than 100,000 observations were studied and these will be tabulated and arranged graphically, but are not yet available. The bulletin gives the details of five estimates which are based upon the cost data published in bulletin No. 2. These are for wagons of the following capacities, which are regarded as being adapted for the service specified: 1000 pounds rated capacity, suburban parcel delivery; 1000 pounds rated capacity, city parcel delivery; 4000 pounds rated capacity, furniture delivery; 7000 pounds rated capacity, draft beer delivery; 10,000 pounds rated capacity, coal delivery.

Taking the suburban parcel delivery the estimated annual expense for the electric is $2455; the gasoline vehicle, $2810; the horse wagon (two-thirds extra horse), $1854. The daily cost is $8.60, $10.40 and $6.50 in the order named; the mileage cost is 23 cents, 27 cents and 23 cents, and the delivery cost 6.7 cents, 7.5 cents and 8.5 cents respectively.

The estimate for city parcel delivery is: Annual expense, electric, $2365; gasoline, $2735; horse wagon (two-thirds extra horse), $1812. The daily cost is $8.30, $10.10 and $6.04 in the order named; the mileage cost is 25 cents, 30 cents and 27 cents, and the delivery cost 4.2 cents, five cents and 4.5 cents respectively.

The estimate for the furniture delivery shows the following: Annual expense, electric, $2794; gasoline, $3366; two-horse wagon (one extra horse), $2457. The daily cost is $9.75, $12.50 and $8.60 in the order named; the mileage cost is 31 cents, 38 cents and 35 cents, and the delivery cost is 31 cents, 38 cents and 35 cents respectively.

The estimate for the draft beer delivery shows: Annual expense, electric, $3252; gasoline, $3854; two-horse wagon (two extra horses), $28.66. The daily cost is $11.40, $14.25 and $10 in the order named; the mileage cost is 37 cents, 43 cents and 46 cents, and the cost a call is 52 cents, 62 cents and 66 cents respectively.

The estimate for coal delivery is: Annual expense, electric, $3610; gasoline, $4380; three-horse wagon (two extra horses), $3135. The daily cost is $12.30, $16.20 and $11 in the order named; the mileage cost is 45 cents, 51 cents and 59 cents, and the cost a ton delivered is 54, 61 and 71 cents respectively.

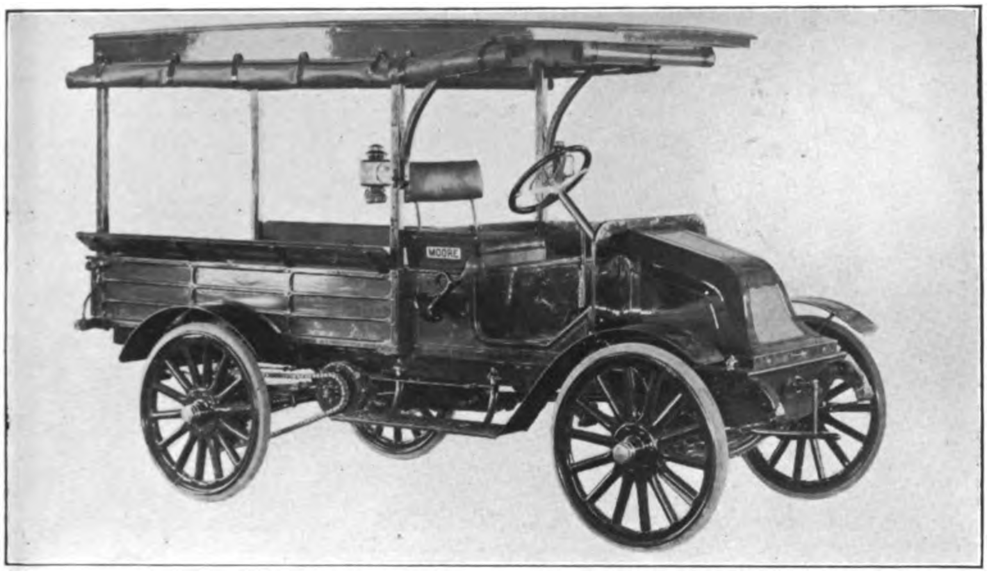
Copies of the bulletin may be obtained by request made to the department of electrical engineering of the Massachusetts Institute of Technology, Boston, Mass.

Tests were made recently at the factory of the Packard Motor Car Company with a number of trucks to determine the efficiency of the brakes and an automatic governor with which the machines were equipped. A loaded three-ton truck moving at the maximum governed speed of 12 miles an hour was stopped in less than the length of the machine, and an unloaded two-ton truck, driven to the limit allowed by the governor, was stopped in nine feet. The trials demonstrated that with liberal braking area and a governor by which the maximum speed of a vehicle may be fixed by the owner, there is very little chance for venturesome drivers to endanger the lives of pedestrians and property by driving at speeds beyond immediate control should emergency require the use of brakes. The tests demonstrate that with the large brakes in good condition, and with the speed limited by the governor, there is little possibility of accident in congested traffic if the machine is properly operated.

MOORE 1600-POUND DELIVERY WAGON.

THE Moore delivery wagon, built by the Palmer-Moore Company, Syracuse, N. Y., is maintained by the builder to be unusually efficient from an operative viewpoint, because of the small consumption of fuel and lubricant and the extreme flexibility of the motor. The capacity of the wagon is normally 1600 pounds, and this rating is applied to all forms of body built. The machine is claimed by the maker to be extremely simple, and constructed of high grade material by skilled workmen. The wagon is the first produced, but other sizes will be built as quickly as the manufacturing plans of the company can be completed.

The wagon is conventional in design as seen with the motor covered by the Renault hood, but examination of the motor shows this to be a decidedly unusual construction. It is designed and perfected by Edward Moore, a designer who is said to have worked 13 years before he produced the construction adopted for the machine. The motor is a three-cylinder, two-stroke cycle, air-cooled type, and it is installed in the chassis frame longitudinally. As constructed there are but few moving parts, the crankshaft, three piston and three connecting rods, and the port shutters being the entire operating mechanism of the motor.



The Moore Delivery Wagon, Capacity 1600 Pounds, Fitted with Standard Express Body.

The cylinders have a bore and stroke of four inches and these are cast with the heads integral with the combustion chamber in half-spherical form. The head has wide longitudinal fins that converge at the top and unite with a horizontal fin, and below this is a series of fins that extends nearly to the bottom of the cylinder. The cylinders are cast separately and have heavy base flanges.

The Moore motor differs from all other two-cycle motors in that it has a control by rotary port shutters that give variable speeds. The cylinders are the three-port type and each port has three rows of holes staggered in arrangement, the holes of the intake being smaller than those in the exhaust port. Each port has a rotary shutter that is so fitted that any row of holes or a portion of the area of any series of holes may be covered or uncovered. For instance, the shutter may be placed so as to vary the fuel that is supplied from one extreme to the other, and as this shutter is moved the shutters of the exhaust port and the by-pass are similarly varied, each shutter registering the same with reference to position. Because of the three rows of holes in each port the motor is said to have three speeds by change of fuel supply, low, intermediate and high, the maximum number of revolutions being 950.

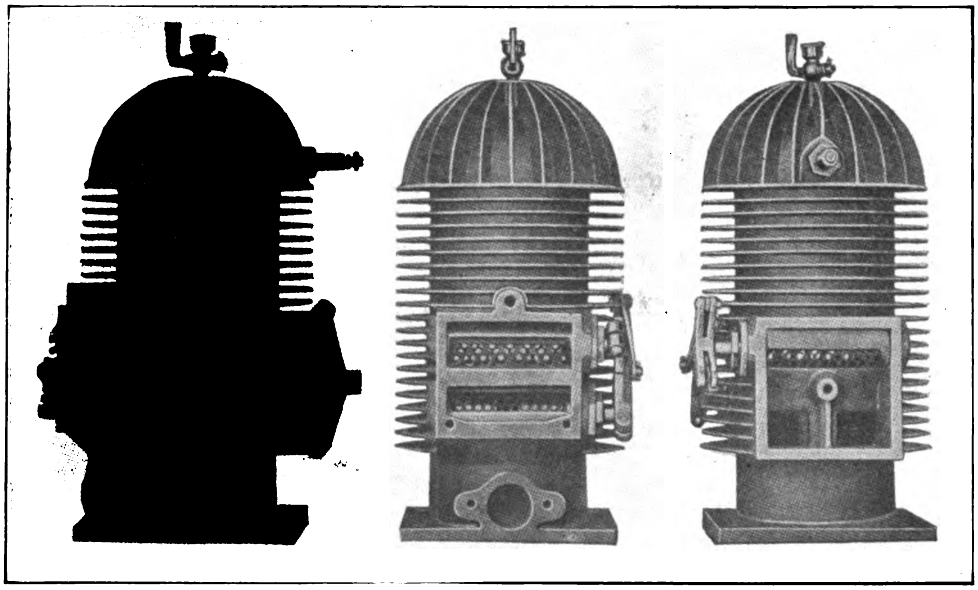
It is claimed for the motor that the speed may be regulated by the rotary valves so as to eliminate possibility of irregular firing or back firing at low speeds and to insure against loss of power at high speeds. The valves are operated by gear segments and bell cranks connected with a lever carried on the steering wheel, and the gear segments are made so that they will mesh in one position only, this construction preventing a possibility of wrong assembling. The shutters are installed with cover plates that may be easily removed for inspection or work. All parts of the motor are interchangeable. It is not necessary to remove the motor as a unit for examination or adjustments.

The crankshaft is very large and is mounted in die-cast bearings, the piston pin and the connection rod big end bearings being of similar material and of liberal proportions. The lubrication is by oil mixed with the fuel in the proportion of one quart of lubricant to five gallons of gasoline, this being sufficient even for the engine bearings, and there are no grease cups or oilers on the motor. The carburetor is a special construction there being a fixed adjustment. The ignition is by a Bosch high-tension magneto with a set position for firing.

The clutch is a multiple disc type and the drive is through a shaft having two universal joints carried in a self-aligning annular ball bearing mounted in a centre frame cross member, the universal joints between the bearing and the planetary gearset, that is assembled in combination with the jackshaft. The gearset gives one forward speed and reverse, there being an interlocking device so that it is impossible to engage either forward or reverse without disengaging the ratio in use. The jackshaft is a special type and is so mounted with the gearset as to be suspended at three points. The drive to the rear wheels is by side chains. The

radius rods have three swivel joints so as to compensate for any distortion of the chassis.

The frame is a pressed steel channel section with large cross members. It is carried on semi-elliptic springs, 38 by two inches forward and 40 by two inches rear. The axles are drop forged from vanadium steel, are I sections, both being 1.75 by 2.625 inches, and have spindles 1.625 inches diameter. These are fitted with roller bearings. The wheels are artillery type, fitted with solid 36 by 2.5-inch tires forward and 36 by three-inch tires rear. The drive is right side and the control is by three pedals, one for low speed, one for reverse, and one for the service brake, with hand levers located in the centre of the footboard operating the high speed clutch and the emergency brake. The control of the rotary valves of the motor is located on the top of the steering wheel, which is 18 inches diameter. The steering gear is irreversible, a worm and pinion construction. The brakes operate on 10-inch diameter drums on the jackshaft and the rear wheel hubs have two-inch faces. Both sets are equalized and are easily adjustable. The wheelbase is 102 inches and the overall length is 156 inches, the loading space of the regular express body being 82 inches length and 45 inches width. The gasoline tank capacity is 16 gallons.



The Rotary Port Shutters of the Moore Two-Cycle Engine, Showing Operating Mechanism.

BUYS MILL AND VILLAGE.

Goodyear Company Purchases Factory in Which It Will Make Tire Fabrics.

The Goodyear Tire & Rubber Company, Akron, O., has purchased a factory village known as Williamsville, in the town of Killingly, Conn., close to the Rhode Island line. The property includes a four-story mill 400 feet long, houses that will shelter 350 operatives and their families, a church, schoolhouse, store, assembly hall, large boarding house, a farm that will be cultivated for the benefit of the employees, Lake Alexandria, which is the local source of water supply, and the Williamsville Water Company.

The Goodyear company purposes to equip the mill with the most modern machinery, and will produce a large part of the fabrics for tires, hose and belting made by it, and besides having exclusive and uniform material will eliminate every expense that would ordinarily be incurred in buying from selling agents of mills.

ELECTRIC VEHICLES WANTED.

European Municipalities Investigating the Possibilities of Motor Equipment.

The bureau of foreign and domestic commerce of the Department of Commerce, Washington, D. C., will place at the disposal of manufacturers of electric vehicles the facts relative to the following opportunities for sales of machines aboard, these being designated by number: No. 10,984, a municipality which has need for two motor ambulances has authorized a medical official, on leave of absence in London, to examine different makes of electric machines, one to be used for general service and the other for the transportation of those stricken with infectious diseases. American dealers so desiring can send information to the London address of this official, or have their representatives visit him. No. 10,987, refers to a municipal engineer who is using an American electric truck in the transportation of city refuse. At the conclusion of the test, which is to continue a month, the engineer, if convinced of the suitability of the machines, may recommend the purchase of perhaps six of different makes, with the purpose of making comparison of them in continued service. From the result of this comparison of work the municipality purposes to purchase 25 machines. American manufacturers of electric trucks who wish to present the merits of their machines should send catalogues and other information, with the prices. Correspondence for both should be in English.

The Quartermaster-General's Department, U. S. A., at Washington, D. C., has issued blanks that have been submitted to prospective bidders to furnish any number of motor wagons of 3000 pounds capacity up to 10,000 accompanied by specifications of the machines that are required. These are, briefly, shaft drive, from 32 to 40 horsepower, with wheelbase from 120 to 144 inches, and either two or four-wheel driven.

TIRE WIDTHS AND LOAD WEIGHTS.

Conference of Interests Proposed to Secure Enactment of Satisfactory Laws.

George C. Diehl, chairman of the good roads board of the American Automobile Association, proposes that a conference be held by the leading state highway authorities and the manufacturers of motor and animal wagons for the purpose of discussing and drafting legislation regulating the width of tires used and the weights of loads to be carried on them, suggesting that when opinions had been obtained a committee could submit a general law that would probably be assured of passage wherever presented by the different legislatures, having as it would the recommendation of the differing interests.

After stating that few states have enforced wide tire laws, although it is known that narrow tires are destructive of roads, and that there is probability of skidding when wide tires are used, he proposes that if narrow tires be used on unimproved roads they should be prohibited on improved highways. He further maintains that the weight of loads should be limited because the bridges are not always constructed to carry traffic of what may be considered excessive weights. He believes that as it is impossible to reconstruct the existing bridges the loads should be well defined and the law enforced. Uniform law is suggested as the most equitable.

Any conference that could be arranged would simply be advisory, and even should all manufacturers of vehicles decide to build and equip wagons to specifications that would be approved, the several millions of wagons and machines in this country could not be changed save at material expense, and unless changed there would be no improvement of conditions. The agreement could only apply to what was produced by the builders and could have no bearing on vehicles now in use.

Then there is the trifling matter of enforcing the law, which would require the inspection of all tires and the weighing of wagons and their loads, whenever necessary, to say nothing of the almost uniform overloading by owners who absolutely disregard the requirements with reference to their own property.

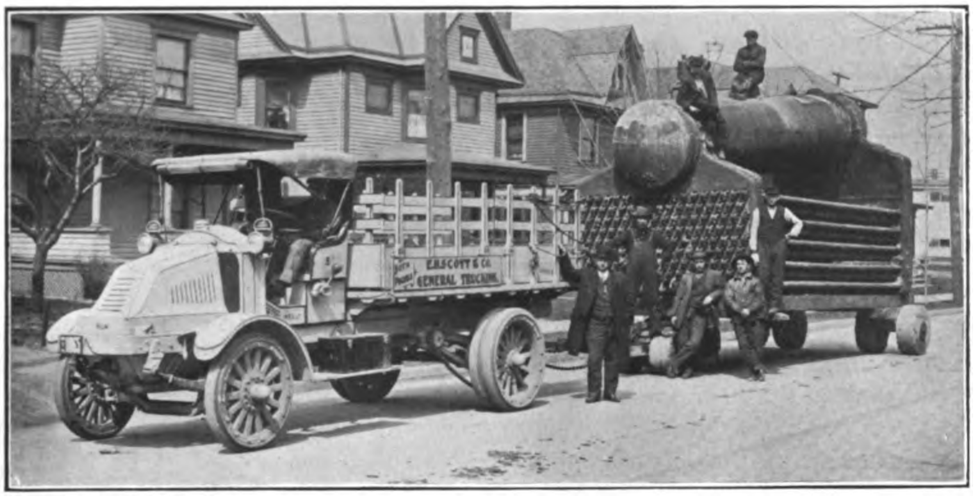
Edgar C. Neal has purchased a considerable interest in the Atterbury Motor Car Company, Buffalo, N. Y., and it is understood that he will be elected vice president of the concern and become an active factor in its management.

TRUCK HAULED 20 TONS.

Three-Ton Kelly Machine Drags Big Boiler Through Erie, Penn., Streets.

The hauling of a boiler weighing 20 tons through the streets of Erie, Penn., was an undertaking that directed much attention to the machine in that city recently. It was necessary to move the boiler a considerable distance to the plant where it was to be installed, and instead of resorting to horses and a special rigging it was proposed to haul it by motor truck. The proposition was made E. M. Scott of E. M. Scott & Co., agent for the Kelly machines, and he agreed to provide the motive power.

The boiler was jacked and under the corners at one end large dolly rolls were placed, while in the centre at the other end a third roll was placed, this supporting the construction at three points, and insuring a certain balance wherever the rolls were with reference to the road surface. A heavy chain was used for towing, and by the exercise of care the boiler was hauled through the streets by a three-ton truck without mishap. The saving of time was material, but the minimized handling was a factor quite as important.



Kelly Three-Ton Truck Hauling a 20-Ton Boiler Through the Streets of Erie, Penn.

The W. C. Hendrie Rubber Company, with capital of $100,000, has been organized at Torrence, Cal., where a factory is to be equipped for the manufacture of motor vehicle tires. The company has established branches at San Diego, Los Angeles, Oakland and San Francisco, Cal.; Portland, Ore.; Seattle, Wash.; Victoria, B. C., and it is probable others will be located in other western cities.

The United States postoffice department at Washington has issued invitations for bids on 20 wagons of 1500 pounds capacity and 20 tricars of 700 pounds capacity, to conform to specifications, the bids to be opened at 2 o'clock June 20 by the committee on supplies of the department. These vehicles will take the place of 100 machines contracted for by Postmaster-General Hitchcock, orders for which were cancelled.

BAY STATE TRUCK TAX BILL DEFEATED.

THE Massachusetts owners of motor service wagons were successful in their opposition to the bill advocated by the state highway commission imposing a tax of $5 for each ton capacity or fraction thereof. The bill was prepared by the commission and to this remonstrance was made by the Boston Commercial Motor Vehicle Association, the Boston Electric Motor Car Club, the Massachusetts State Automobile Association, the American Automobile Association, the Boston Automobile Dealers' Association and differing owners of wagons and trucks. The commission made agreement that a bill should be prepared that made the registration fee for the first ton $5 and $2.50 for each additional ton or fraction thereof. This bill could have been passed without opposition, but the commission attempted to force the passage of the original and this was regarded as a breach of faith that justified the endeavors of all interested in killing the bill. The bill had been reported favorably by the committee on roads and bridges, but was recommitted and hearing was given those opposing it. Again it was reported favorably, and it was passed by the senate by a vote of 19 to 18. The bill then went to the house and there it was defeated May 29 by a vote of 126 to 66, after a number of amendments had been proposed, one of which required a fee of $2.50 for the first ton capacity and $2.50 for each additional ton or fraction thereof.

Against this measure the agents for service wagons and owners of machines made a united campaign, and they were joined by several labor organizations. The remonstrants did not lack aggressiveness and they had an excellent organization and good legal advisors. One result of the agitation was to unite many business interests operating motor vehicles for protection against unjustified legislation and to well establish the fact that revenue and nothing else inspired the recommendation of the highway commission. In addition the service wagon owners are to be organized for mutual benefit, there being widespread approval of such organizing. One of the reasons for this is belief that the effort to tax business vehicles will be renewed in 1914, and organized endeavor must be made during the next campaign to defeat all candidates not favorable to what is considered equitable legislation.

The supreme court of Mississippi in a decision of May 29 declared the law requiring a license fee for the registration of automobile vehicles to be unconstitutional and void. This statute became law June 1, 1912, and it provided for the usual licensing according to horsepower—$5 for a machine of 25 horsepower or less, $15 for a machine of more than 25 and less than 40 horsepower, $20 for a machine of more than 40 and not more than 50 horsepower, and $25 for a machine of more than 50 horsepower. In its opinion the court holds that the legislature sought to collect an unreasonable tax under the guise of police power. This decision means that the state must refund all automobile licenses collected under the law, amounting to $28,115. This is the first state supreme court to decide that an automobile licensing law was unconstitutional. The New Jersey supreme court, in the case of a non-resident who refused to pay the license fee on the ground that it was a tax, and that the enforcement of the law was in violation of the federal statute governing interstate commerce which authorized a non-resident to pass through the state without payment of a fee, practically decided that the license fee required was not of such proportions as to be regarded as a tax. This implied that had the fees been such as are at present required, or such as the Mississippi law demanded, the determination might be that the fees were unconstitutional.

GIMBEL ADDS MORE WHITES.

Well Known New York Department Store Now Has 42 Wagons of This Make.

The sale of 16 White delivery wagons to Gimbel Bros., the well known New York City department store, announced by the White Company, Cleveland, O., is one of the largest motor truck installations of the year and it follows closely upon other large sales to New York stores, notably the delivery of 15 vehicles to Stern Bros. The 16 trucks purchased by Gimbel Bros. comprise an addition to a fleet of 26 White machines which have been in the service of the company for 1.5 years.

This increased installation is equally important from the standpoint of delivery efficiency, inasmuch as all of the 42 trucks are exactly alike, enabling the firm to take the utmost advantage of uniform design, as well as the accompanying simplicity of operating, garaging and maintenance. Gimbel Bros.' delivery department is maintained on progressive lines. The company's own men handle all adjustments and simple repairs. Not one of the White trucks owned by this concern has ever had to be sent to a White service station.

In their first month of service, the five KisselKar wagons, made by the Kissel Motor Car Company, Hartford, Wis., used in the parcel post delivery and collection system at Washington, D. C., have demonstrated their sturdy quality and fitness for the duty exacted of them. They have each averaged a daily mileage of 35, with 195 stops. No repairs have been required and although the motors are allowed to run constantly, the fuel consumption has been but one gallon to each 14 miles.

An order for six Stewart delivery wagons of 1500 pounds capacity has been received by the Stewart Motor Corporation, Buffalo, N. Y., from Pratt & Co., Buenos Aires, Argentine.

SEPARATE TAXES FOR SERVICE WAGONS.

States Where the Registration of Freight Carrying Vehicles Is Segregated from That of Passenger Cars---Special Requirements Relative to Speed, Weight, Etc.

THE owner of motor vehicles used for business purposes must regard the significance of the enactment of law by some of the states that means, if it means anything at all, the purpose of legislators to tax all machines so far as the owners will endure. The original intention of those who advocated and brought about the registration of automobiles was to have a means of identification and to establish responsibility for accidents. The payment of such a fee as would be legitimately used for the maintenance of a permanent bureau and meet the necessary expenses was not regarded as burdensome. Out of this policy was developed the taxation of motor cars, which it was maintained were destructive of roads. In many instances the fee has been increased to such proportions that it cannot be regarded as anything else than a tax, and, in fact, the purpose of the legislators is to create a fund and provide means for its expenditure.

In many states the service wagon has been taxed as has been the pleasure car, on the basis of horsepower. In others the fee is established without regard to capacity or power. While there are states that still do not require more than the cost of issuing the registration certificate, it is not to be denied that the disposition of the legislators has been to impose taxes, generally such amounts as to arouse vigorous protest.

Of the 49 states and districts of the United States, not considering Alaska or the island possessions, 12 have laws which segregate the service wagons from pleasure cars. In two states bills are now pending, or, if they have been made law, have not as yet become effective. The states where the registration fee is not the same as for the pleasure car are as follows:

Alabama—The law passed in 1911 provides that all motor vehicles used for public hire in transporting passengers or freight shall be licensed for a fee of $25. This does not require the licensing fee for the operation of machines that are used in the business of the owner, but imposes a tax upon those used constantly or casually in public service.

Connecticut—The law enacted in 1912 provides that service wagons of 1000 pounds capacity or less shall be licensed for a fee of $5, and that the fee shall be increased $2 for each additional 1000 pounds capacity or fraction thereof. This law may be repealed by a bill now pending before the legislature which requires a license fee of $7 for service wagons of 1000 pounds capacity or less, and increases the fee $3 for each additional 1000 pounds capacity or fraction thereof. The law now requires a fee of $15 for a three-ton truck, $23 for a five-ton truck and $33 for a 7.5-ton truck. The proposed law would tax these same trucks $22, $34 and $49 respectively.

Indiana—The law that became operative June 1 of this year requires a license fee of $5 for all service wagons without reference to capacity.

Maine—The law enacted in 1911 requires a license fee of $10 annually for all vehicles used for business purposes without regard to capacity. A law will become operative in that state July 11 of this year that prohibits the operation of any traction engine, trailer, motor or other vehicle upon or over any highway or bridge of the state, or the moving of any other object upon wheels, rollers, or otherwise, in excess of a total weight of nine tons, including vehicle or means of conveyance, without obtaining a permit from the Maine highway board, county commissioners, superintendents of streets, selectmen or road authorities, which permits may be general or limited as to time and the particular roads and bridges which may be used, and may contain any special conditions or provisions which in the opinion of the authorities are necessary; and the authorities are empowered to limit the speed of vehicles affected by the law to six miles an hour on any bridge by posting notice at either end. This law also prohibits the use of any flange, rib or any projection from a tire that will cut into or affect the surface of any highway, and the operation of any engine, vehicle or conveyance that has a weight of more than 800 pounds upon any inch width of tire, roller, wheel, etc.; or the operation of any vehicle carrying a weight of six tons or more, including the vehicle, at a speed of more than six miles an hour. The penalty is a fine from $10 to $500, to be paid to the town or city in which the damaged bridge or road is located, or to the county in the event of being in any unorganized township.

Maryland—The law enacted in 1912 requires a fee of $3 for the registration of all service wagons without reference to capacity.

Massachusetts—The law enacted in 1909 requires a fee of $5 for the registration of any service wagons without regard to capacity.

Michigan—The law passed by the legislature this year establishes a registration fee of 50 cents a horsepower of engine rating and does not regard capacity.

New Hampshire—The law now in effect establishes the following fees for registration: One ton capacity, $10; one to two tons, $12.50; two to five tons, $15; more than five tons, $20.

New Jersey—The law now operative requires a fee for registration of $4.50 for 10 horsepower or less, $7.50 for from 11 to 29 horsepower inclusive, $15 for 30 or more horsepower, and $10 additional for service wagons weighing more than 4000 pounds unloaded.

New York—The law enacted this year requires a license fee of $5 without regard to vehicle capacity.

Rhode Island—The law of 1909 requires a license fee of $2 without reference to capacity.

FEDERAL SOLVES PROBLEM.

Cherry Pickers in Oregon Now Find It Possible to Utilize Trucks.

A scarcity of transportation vehicles is usually apparent during the cherry picking season in Oregon, which lasts about three weeks. Most of the ranchers sell their crop as it stands upon the trees, and the purchaser must do all his own picking and shipping. The poor roads and trails make it difficult for a motor truck to reach the orchards in the highlands and burro caravans and pack horses have almost invariably been used.

Last year C. A. McCrary of LaGrande, Ore., used a Federal truck, made by the Federal Motor Truck Company, Detroit, and demonstrations in and around the mountains showed that this wagon could fulfill the requirements. Loaded with about 2200 pounds of camping paraphernalia, a 16-mile trip was made up the mountain to a large cherry orchard, where 10 days were spent. Every second day the truck carried its cargo of cherries 128 miles from LaGrande to The Core, where they were turned over to a local cannery. It is predicted that this year motor trucks will be used more in making these trips, because they not only save time, but are economical, none of the fruit being wasted by exposure to the sun as is true when horses and wagons are the only means of transportation.

If the plans that are now making are realized the Gramm Motor Truck Company, Lima, O., will produce 2000 of the Willys Utility type. The production of the factory will be largely given over to these machines. It is stated that 500 of these are now being constructed, and the remainder will be built during the year. The company now employs 400 men, and this number will be increased to 600 in a comparatively short time, which will nearly double the capacity.

ELECTRIC PASSENGER 'BUS.

St. Louis Department Store Utilizes Luxurious Vehicle for Its Customers.

A vehicle of unusual body design is utilized by the Famous & Barr Company, which conducts a department store in St. Louis, Mo., to transport its customers from the McKinley station to the store in that city, this being a convenience that has influenced a considerable volume of patronage. The round trip is exactly a mile and the 'bus has averaged 32 daily, with a maximum of 35, the weather and traffic conditions being the governing factor. The average number of passengers carried has been 450.

The 'bus has a standard General Vehicle two-ton chassis on which is installed a unique and ornate body, which was designed by a General Vehicle salesman, who was formerly in the service of the engineering department of the company. The body was built in St. Louis. The body has but one entrance, that being the sliding door that is shown in the illustration, and there are two folding steps which fall into position as the door is opened and are folded as the door is closed. The operating mechanism for the door is practically the same as is used for trolley cars, and it is controlled by a lever at the right of the driver, who may open or close the door without moving from his seat. The body is a fine example of coach work and it is lighted by windows at the sides and ends. The seats will accommodate 18 persons comfortably.

The Handsome Special General Vehicle Omnibus Used by the Famous & Barr Company, St. Louis, Mo., to Transfer Its Patrons from Station to Store.

The 'bus was placed in service with a view to bringing to the store persons who would otherwise have to walk or pay car fare, and it was desirable to have an appearance that would attract attention. This was the chief thought in working out the body design, and certainty of service as well as economy were essentials that impelled the use of the electric.

The Lincoln Motor Car Works, Chicago, Ill., had occasion to take about 100 wagons that were not equipped with tires from the works to a freight train for shipment, and after considering differing projects had four sets of tires made of manila rope, two inches diameter, which could be quickly removed after the machines had been placed in the freight cars, and installed on other wagons. The wagons were driven in groups of four to the freight yard, accompanied by another wagon, which brought the drivers and the rope tires back to the works, when the process was repeated. No rims were damaged and the expense of handling the machines was comparatively small, a total time of three days being required for the completion of the job.

ELECTRICS MAKE BIG MILEAGE.

Five Different Atlantic Machines Make Remarkable Records in Daily Service.

Five different Atlantic wagons and trucks recently made exceptional mileages in the course of service, and this without reaching the full capacities of the batteries. April 28 a one-ton wagon owned by A. Silz, Inc., 414-18 West 14th street, New York City, after making 51 miles as a day's work was sent out to tow in another make of machine, covering six miles more, or 51 for the day. It is estimated the battery charge would have carried the machine six or seven miles more.

May 7 and 8 a five-ton Atlantic truck owned by the Kips Bay Brewing Company, 57th street and First avenue, New York City, making deliveries on the east and west sides south of Bleeker street, made 52 miles on one charge of the battery and could have made eight miles more before the energy would have been exhausted. This truck has a battery slightly undersized.

May 14 a 3.5-ton Atlantic truck just completed for the General Chemical Company was sent with a full load for 61 miles over the streets of Newark, Elizabeth and Harrison, N. J.

May 15 a five-ton Atlantic truck, making deliveries for Picker Bros., wholesale wine merchants, 313 West 125th street, New York City, working in Brooklyn and lower New York, made 56.8 miles, the last 25 over slippery streets, and there was energy sufficient remaining in the battery for several miles.

May 16 a 3.5-ton Atlantic truck was sent from the Atlantic factory with a full load over streets in Elizabeth, Newark and Passaic for 30 miles. It was then unloaded and with a weight representing a standard body was driven over the same streets for an additional 59 miles, making a total of 99 miles. This performance is sworn to by Paul C. Diesing, the driver, who swears that the Stewart & Clark speedometer and odometer was in good working order and that the machine was not charged during the run. The truck was equipped with a 21-plate Hycap Exide battery. The average running speed was 9.25 miles an hour. This is the best record yet made by any Atlantic machine.

Standard sizes of Exide batteries were used in all of the machines to which reference has been made.

LARGEST PACKARD FLEET.

Figures Show New York Contractor Operates These Trucks at Cost of $10.20 a Day.

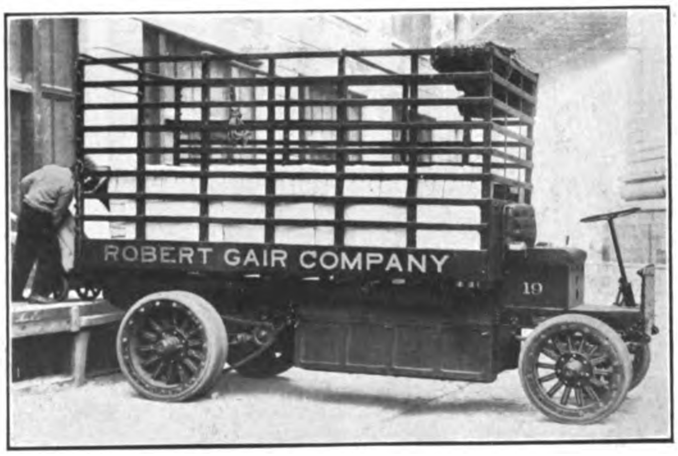
The average daily cost of operating one of the Packard trucks in the service of Oscar Daniels of New York City, is $10.20. This figure, which includes depreciation, interest and insurance, is taken from cost sheets covering the period from Nov. 1, 1911, to Oct. 31, 1912.

The contractor is engaged in the excavation of section 12 of Lexington avenue subway from 111th to 118th streets.

Eight three-ton trucks, equipped with special dumping bodies, are loaded from a hopper, thus reducing to a minimum the time required for this work. The material is hauled to the East river at the foot of 110th street. The entire distance covered does not exceed one mile for the round trip. Each truck hauls three cubic yards to the load and completes 24 trips in eight hours. The scheduled time for the completion of this job is three years.

Using eight trucks, the company completed 38 per cent. of the work in 10 months' time. Continuing at this rate it will be able to finish the work about one year ahead of schedule. An order for 10 additional trucks makes a total of 18 purchased by the company of the Packard Motor Car Company, Detroit, and makes the largest fleet of Packard trucks in the service of any one contractor.

A. P. Foss of Lakeside, Cal., a fruit grower, utilizes a model H Reo wagon, made by the Reo Motor Car Company, Lansing, Mich., to haul fruits to the railroad



A Five-Ton Atlantic Electric Truck Fitted with a Crate Express Body That Is Protected by Tarpaulin Covers.

station and do other work on the farm until late in the fall. Last year, at the conclusion of the summer's work, the machine was used on a tour to Orville, Butte county. The trip lasted a month, during which Mr. Foss says he travelled 1400 miles with an expense of 10 cents for repairs. The 1500-pound machine has been in service one year.

John Swincoe, formerly chief engineer of the Driggs-Seabury Ordnance Corporation, Sharon, Penn., has associated himself with the Weston-Mott Company of Flint, Mich., maker of motor vehicle axles, etc.

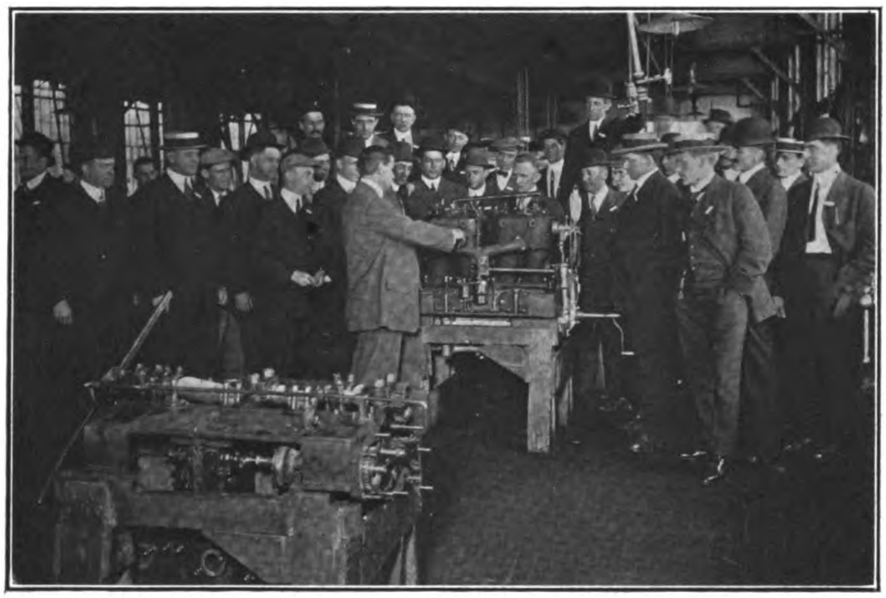
Much valuable information for all owners and users of motor vehicles is contained in a booklet entitled "The Care of Leaf Springs," published by the Sheldon Axle Company, Wilkesbarre, Penn., which will be sent to any person sending request to company's office.

BRIEF NEWS OF MANUFACTURER AND THE TRADE

The Knickerbocker Motor Truck Manufacturing Company, New York City, has completed arrangements for issuing new stock and has already sold $250,000 of its issue. The intention is to erect a larger factory in the Bronx, capable of turning out about 150 trucks a year, which is about treble the present capacity.

Carl G. Fisher & Co., and the Hunter-Hammond Auto Company, both of Indianapolis, Ind., have combined their interests and have incorporated the Fisher Automobile Company with capital stock of $25,000. The new concern is composed of the following: President, Carl G. Fisher; vice president, Harry L. Hammond; secretary-treasurer, F. Ellis Hunter. The headquarters will be at 400 North Capitol avenue, formerly the headquarters of Carl G. Fisher & Co. The firm will handle Reo, Stutz and Packard pleasure cars and Packard and Reo trucks.

Teaching drivers of motor trucks to know the abuses of overloading and fast driving was one of the chief purposes of the service convention at the Providence, R. I., factory of the American Locomotive Company, May 27-28, which was attended by about 50 men from New York, Chicago, Philadelphia, Boston, Pittsburg, Richmond, Newburgh, N. Y., Montreal and the Pacific Coast. George H. Duck, manager of the general service department, was chairman, and the speakers included General Sales Manager C. Arthur Benjamin, Factory Manager F. P. Nehrbas, Chief Engineer R. A. Vail and J. F. Gfrerer, manager of the dealers' service department. Economy of operation was the object sought by each speaker. Besides hearing the addresses the visitors inspected the factory and witnessed demonstrations of the construction of the machines.



Delegates to the Service Convention Held May 27-28 at the Providence Factory of American Locomotive Company, Listening to a Lecture on Alco Truck Motor.

William E. Barker, formerly president and treasurer of the Enterprise Rubber Company, Boston, Mass., has been appointed sales manager of the United States Rubber Company, with offices at New York City.

W. H. Harsh, formerly general manager of the Kelly Island Lime & Transportation Company, has been appointed assistant general manager and assistant treasurer of the Sandusky Auto Parts & Motor Truck Company, Sandusky, O.

The production of the Brown Commercial Car Company, Peru, Ind., has been materially retarded by the conditions that have resulted from the inundation of that section of the state last March. It was necessary to do much additional work on machines damaged in the flood, and material has been received slowly because of similar retardation of other factories. Not only this, many of the stockholders have been compelled to give attention to other enterprises, so that while cooperation has brought about excellent results, time has been required for the company to resume its former productiveness. The Brown wagons in service have given a very large measure of satisfaction and the prospect for the company now appears very bright.

The Electric Home, San Diego, Cal., has occupied its newly erected garage at 3227 Fifth street. The company also has opened an agency for the Waverley electric cars, made by the Waverley Company, Indianapolis, Ind. W. L. Lowe and H. O. Hattel are the proprietors.

C. F. Kircher has been chosen manager of the truck department of the Pacific Car Company, Seattle, Wash.

George Walker, formerly sales engineer of the Muncie Gear Works, Muncie, Ind., is now chief engineer of the Benton Motor Car Company, Benton, Ill.

Charles Basle, the racing driver, has been secured by A. H. Sowers to take charge of the assembling plant of the Sowers Motor Truck Company, Boston, Mass.

M. A. Magee, who for several years has been connected with the Motz Tire & Rubber Company, Akron, O., maker of Motz tires, has succeded P. M. Pontius as sales manager. Mr. Pontius is specializing in the work of the electric vehicle tire and is now officiating as the manager of that division.

Carl Neracher, chief engineer of the Willys-Overland Company, Toledo, O., maker of Overland machines, has gone to Europe for a needed rest. Incidentally he will examine European conditions and engineering practise.

W. H. Lally of the export department of the Studebaker Corporation, Detroit, maker of Studebaker pleasure and commercial vehicles, has returned to Detroit after a trip of six months around the world, during which he visited nearly all the Studebaker agencies.

The Chambray Carburetor Company, Detroit, was recently incorporated with $50,000 capital stock, the name of the concern being a combination of part of the names of two of its chief incorporators, who are as follows: John H. Chambers, John W. Mowbray and Charles H. Bennett.

The Wallis Tractor Company, Milwaukee, Wis., formed with $800,000 capital, has rented the factory buildings located on East 72nd street, near Clair avenue, formerly occupied by the Royal Automobile Company, and will manufacture traction engines on a large scale. H. M. Wallis, Sr., and H. M. Wallis, Jr., are the main stockholders.

The B. F. Goodrich Company, Akron, O., maker of Goodrich tires, has encountered such a demand for its product in Canada that it has been decided to build a large factory to supply the Canadian needs. Thirty-two acres of land have been secured at Saint Catharines, Ont., conveniently located for the handling of traffic by railroad, and the new factory will be modelled on the lines of the parent Akron plant. When fully developed it is planned to employ at least 1000 men, with ample provision for future expansions.

The Grant-Lees Machine Company, Cleveland, O., has been reincorporated under the name of Grant-Lees Gear Company. This is to express more concisely the chief activities of the company, which recently made several large additions to its plant.

The Ralston Motor Company, Omaha, Neb., has amended its articles of incorporation and is now known as the Omaha Tractor & Engine Company. The capital stock is $500,000 and the incorporators are: H. E. Johnson, H. K. Burkett, Isaac Kahn, Gottlieb Brunnenkant and E. C. McGilton.

The Wagenhals Motor Car Company, Detroit, maker of a three-wheel commercial car, has increased its capital from $100,000 to $500,000, and will locate in a much larger plant in order to increase its output. William Pflum of Dayton, O., formerly manager of the National Cash Register Company, is interested with Mr. Wagenhals and is preparing to take an active part in pushing the company's product to the front.

Ray Longacre has joined the sales department of the Star-Tribune Motor Sales Company of Detroit, distributor of Star trucks and Tribune pleasure vehicles.

The Mansur Motor Truck Company, Haverhill, Mass., has been formed by George B. Mansur, Kirke L. Moses and Nelson L. Forbush, with capital stock of $30,000.

N. S. Hopkins has resigned his position with the American Locomotive Company's automobile plant at Providence, R. I., where he had charge of the main manufacturing department.

The Chicago Universal Motor Truck Company has been incorporated at Chicago with capital stock of $10,000. Those interested are E. C. Rockwell, James H. Dunn and C. M. Stevens.

The Hillman Taxi Service Company, Mobile, Ala., has incorporated with $2000 capital stock, of which $1000 is subscribed. The incorporators are George D. Hillman, Mary F. Hillman and Rosina Hillman.

The De Dion-Bouton Selling Branch, New York City, has moved its showrooms to 1612 Broadway, on the northeast corner of 52nd street. The garage and repair department is located at 110 West 54th street.

The Palmer-Meyer Motor Car Company, St. Louis, Mo., maker of Palmer trucks, has appointed the following agents: Louis Schnellman, Luxemburg, Mo.; Henry J. Jenneman, Mattese, Mo.; C. J. Siedler, Maxwell, Mo.

Glenn W. Barden has been appointed secretary and treasurer of the Kelly-Springfield Motor Truck Company, Springfield, O., maker of Kelly trucks. He was formerly auditor of the Warren Motor Car Company, Detroit, maker of Warren cars.

M. E. Morris has been appointed Pacific Coast manager for the Goodyear Tire & Rubber Company, Akron, O., to succeed W. T. Powell, who has resigned. F. E. Carroll remains manager of the local branch at San Francisco, Cal.

Joseph Tracy, consulting engineer of New York City, has again moved his laboratory in Rutherford, N. J., to larger quarters as a result of the increasing demand for demonstration and development testing. At the new plant six to eight motors may be tested simultaneously.

The Knox Automobile Company, Springfield, maker of Knox trucks and the Knox-Martin tractors, is to transform its representation at Boston from an agency to a branch office, which will be in charge of Frank B. Crockett, who was formerly connected with the Underhill Company in that city, the Boston agent for the Knox company since 1901.

The Kelly-Springfield Motor Truck Company, Springfield, O., maker of Kelly trucks, is to establish an assembling plant at San Francisco, Cal., according to Charles B. Shanks, general sales manager, who recently made a trip to the Pacific Coast to investigate the situation. The new plant will supply the demand for the Kelly product west of Denver, Col.

The Pittsburg Taximeter Company, Pittsburg, Penn., one of the largest makers of taxicab meters in the country, recently closed contracts to equip all the machines owned by the Detroit Taxicab & Transfer Company and the cars of the Cleveland Taxicab Company. The company also has a large order for its product to be shipped to Rio de Janeiro, Brazil.

The Stewart Motor Corporation, Buffalo, N. Y., recently appointed the following dealers to handle Stewart light delivery cars: Fred H. Van Dorn, Red Bank, N. J.; Draper Garage, Northampton, Mass.; G. E. Clark, Herkimer, N. Y.; H. B. Gray Company, Fort Plain, N. Y.; Johnstown Motor Car Company, Johnstown, N. Y.; William Petry Garage, Hudson, N. Y.

H. B. Willower, who has for the past two years represented the Gramm Motor Truck Company, Lima, O., maker of Gramm trucks, throughout Illinois, Indiana, Kentucky and Michigan, has joined the sales staff of the Gramm-Bernstein Company, Lima, maker of B. A. Gramm's trucks. Mr. Willower is one of the most successful salesmen in the motor truck field.

William Sternberg, engineer of the Sternberg Manufacturing Company, West Allis, Milwaukee, Wis., maker of Sternberg trucks, recently sailed from New York City for a tour of Europe to last several months. He expects to make the trip one of business and pleasure, visiting the more important points in the manufacture of motor trucks abroad, and investigating closely the features and conditions of the industry in general.

B. F. Schmidt and L. R. Ingrabrand have been advanced from foremen's positions to those of superintendent and assistant superintendent, respectively, in the factory of the Speedwell Motor Car Company, Dayton, O., maker of Speedwell motor cars and trucks. Both men have been with the company since its inception. The former was foreman of the chassis assembling department and the latter of the final assembling department. Jacob Neibert succeeded Mr. Schmidt as foreman of chassis assembly. The changes came as the result of the resignation of Superintendent Dunston.

The Pacific KisselKar Branch is having plans drawn and will soon break ground for a new sales and service building to be located on Van Ness avenue, San Francisco, Cal. It is intended to erect a structure that will eclipse in size and completeness the big KisselKar service station recently opened at Chicago, which contains 70,000 square feet of floor space.

L. S. Crane, Atlanta, Ga., announces the removal of his business to 328 Peachtree street, where will be carried a complete line of Pope-Hartford automobiles and trucks, motorcycles bicycles, lubricants, etc.

The Adams Bros. Company, Findlay, O., maker of Adams trucks, has designated the following new agencies: Holcomb Company, New Haven, Conn.; Fisher & Lambine, Kittanning, Penn.; Charles R. Roehl, Caracas, Venezuela; Cuba Electric Supply Company, Camajuani, Cuba.

LUBRICATING OIL.

(Continued from Page 414.)

The motor after leaving the factory is run at great variations of speed and considerable variation of load. These variations are quite rapid and frequent. On account of the mechanical conditions of the motor you have recommended a very thin, light lubricating oil for the motor, under the guarantee. This lubricating oil has no particular adhesiveness and will flow as readily from the cylinder wall as to it. Consequently, during the rapid and frequent variations of speed, cylinder walls are sometimes overburdened with oil and sometimes practically dry, making wear and tear excessive and naturally resulting in a very rapid increase in the space between the piston and cylinder wall. This wear and tear is not thoroughly even; the clearance is larger in some places than in others. Then the lubricating oil flows freely up and down the walls of the cylinder and there is never any time when just the proper amount of oil is on the cylinder wall. The oil is so thin that it cannot be held in the increased space, consequently on the compression stroke the gasoline mixture escapes past the piston, destroying the lubricating oil in the crankcase, and reducing from 15 to 30 per cent. the power which should be secured from the gasoline.

Further, the condition under discussion is responsible largely for the carbon which is so constantly being experienced on account of the fact that the oil, being very light in body and free flowing, is drawn up during the suction stroke into the compression chamber and on to the piston head, where it is distilled, leaving a coke baked on the piston head to the first ring, upon the valves, etc.

Consider instead of the mechanically secured compression used in connection with thin oil, compression which depends upon the use of lubricating oil, the clearances being larger. From the standpoint of the mechanical efficiency of any power generator, and, in fact, any moving equipment, the best fit—that is, the mechanical fit which absorbs the least amount of power due to friction in the power generator itself—is an easy sliding fit. If dependence is to be laid, however, upon the metal and not upon the lubricating oil to maintain compression, this easy sliding fit is too loose to give the compression required. If, however, it is intended to secure the compression by the liquid seal of the lubricant, then an easy sliding fit can be given to the motor, a sufficiently heavy-bodied oil used for lubricating with the result that the metal surfaces can be kept apart, the compression can be maintained so that there will be practically no change in the lubricating oil in the crankcase and only the ordinary wear and tear on a properly lubricated surface will take place, which wear and tear is infinitely slower than the wear and tear which usually occurs under the conditions previously mentioned.

Nevertheless, it remains true of all our tests, experiments and information that the general practise of the motor manufacturer in this country has been to use clearances between piston and cylinder wall which were entirely too small and to use lubricating oil which was entirely too thin. This was undoubtedly due to the attempt to get away from carbon troubles and gummy deposits, but a little reflection will show that the excessive carbon troubles are mainly to be connected with too thin an oil. While oils from some crudes, of course, give only soot, and other oils give coke when burnt in the combustion chamber, the carbon in each case is due to the presence of oil where it has no business to be and where under proper mechanical conditions it would not arrive. Provided the oil has sufficient body to adhere to the cylinder wall and the piston rings so that at all times a perfect, or practically perfect, seal is maintained practically no oil should get up into the compression chamber, onto the valves or the piston head, inasmuch as if the oil has sufficient body to adhere to the cylinder walls during compression it will have no tendency to climb during the suction stroke, and consequently at no time will there be any large amount of excess oil where it will be affected by combustion. I have no doubt whatever that the motor manufacturer has in the past made a mistake in pressing the oil companies to give him a product which would not deposit any carbon, instead of examining the mechanical conditions of his motor and finding out whether it was necessary to burn oil. Under some conditions it is impossible to avoid carbon. The character of the carbon depends partly upon the character of the crude, the method of refining and the character of the oil made necessary by motor mechanical arrangements, but the cause of the continued presence of excessive carbon and continual trouble with carbon should be looked for, it seems to me, in the mechanical conditions of the motor. When these mechanical conditions are examined it will be more fully determined that we have not been securing the economy which should be secured from the fuel or the lubricating oil and that the depreciation due to excessive wear has been too rapid.

The
MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., JULY, 1913 No. 7

BOSTON'S DELIVERY PROBLEM.

Distribution by 367 Recognized Express Companies, 343 of Which Are Purely Local, and Few Are Motorized—Big Department Stores Have Some Motor Equipment, but Only One with Facilities for Quick and Economical Loading.

By William W. Scott.

THE MOTOR TRUCK has undertaken a survey of the transportation conditions in many of the large cities of the country with a view of giving facts that will show what must be dealt with by not only the manufacturers of vehicles, their agents and representatives, but the business men and the people as a whole, for it is evident enough that only through a thorough understanding of the needs of each locality the solution that will eventually lead to realization of economies can be reached.

In cities of such size to justify the designation of commercial centre there are many active enterprises, and those directing them usually regard the conditions met with so far as they relate to their own businesses, but these men have no concern in the effect these conditions may have with reference to their competitors and associates. They may be conversant with their own service and with others that may be available in the event of need, but few, if any, have occasion to ascertain actual facts as to the volume of transportation, the number of concerns engaged in transporting goods and commodities, of the co-operation and methods of transfer, the detail of handling, the times of delivery and collection for shipments and the manner in which deliveries are made by the receiving companies. The value of information of this character is so great that it cannot be overestimated.


Shipping Room Crew at the Houghton & Dutton Store, Boston, Sorting the Packages for Distribution into the Bins Assigned to Each Route and Vehicle.

It is evident that distribution by the enterprise, whatever it may be, is proportionate to the requirements of its patronage. The manufacturer of the motor wagon and truck bases his business on the knowledge that these demands exist, but it is his work to produce what will serve those requiring conveyances, dealing with manufacturing and designing, and depending upon his sales department to dispose of the machines produced. The sales manager in turn looks to his branches and representatives to so demonstrate the economies of motor haulage that he can sell the production of the factory.

The men selling trucks are assumedly educated to the qualities and merits of the vehicles they sell, though oftentimes they are not as well informed as good judgment would demand, and their purpose is to approach business men and convince them of the value of the machines from their points of view. In the event of sales the purchaser is frequently left to work out his own problems, and the salesman goes along to another prospect and endeavors to make another sale. The buyer of the vehicle may have been careful enough to have studied his work and planned the use of the machine to get what appears to him to be the most that is practical or possible, but unless he has intimate

Houghton & Dutton Shipping Room, the Crew Distributing the Packages into the Bins Ready for the Coming of the Vehicles.

The shipper follows the policies of his superiors and he conducts his service with reference to the demands, he having the control of his drivers in the actual vehicle delivery and dictating what other method of transportation shall be used. He is guided by his training and knowledge, and by his experience, and, sometimes, prejudices.

If the truck salesman had the knowledge of the shipper of each establishment he would be ideally qualified to deal with each individual problem. Those who purchase vehicles have not usually detail of service in mind. In fact they are frequently only generally informed. They leave to those in charge of this work the supervision and administration. It is rare that they have occasion to go into this subject deeply. The truck salesman cannot go into the actual detail of transportation improvement with those who have no intimate knowledge of that detail, even were he qualified to do so, but if he has the broad understanding of all possibilities of locality service he can demonstrate the usefulness of the motor equipment clearly and logically. While it is not reasonable for all salesmen to acquire this information sufficiently to apply it equally well to every form of transportation, it is entirely practical for those directing sales in the territory to give such attention to each business requirement as will make possible the working out of tangible plans for improvement, such as can be used by the salesmen to good advantage.

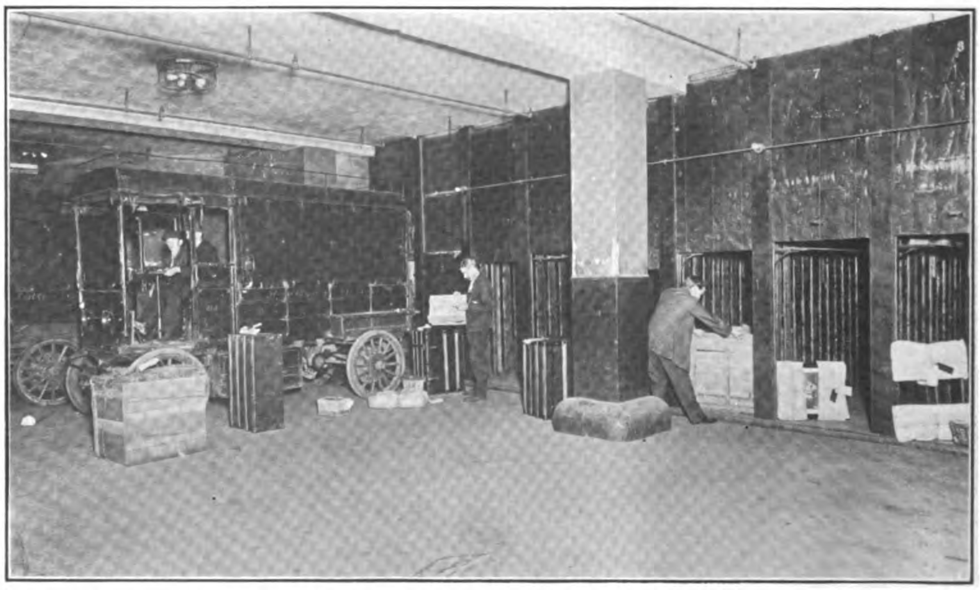
There are, of course, many aspects from which highway haulage can be considered. Each business

knowledge of his service and can direct his men so they will keep the equipment busy, the promised economies are not realized. Without opportunity to study the transportation service of others, or capacity to adapt and develop methods, or resources to install facilities, it is not possible for the truck or wagon owner to bring about a material saving, while the neglect or abuse of the vehicles may entail loss that cannot be compensated.

The average motor truck salesman is not a transportation expert. There are those who are abundantly qualified to investigate a service and devise means for material improvement, but such men are rarely met with. Without the practical knowledge of the conditions—and this ought to include every aspect—no man can successfully advise the man who wants information and instruction. No matter how well versed the salesman may be mechanically, and mechanical experience is not underrated, he cannot give the positive and specific facts so much needed unless he has carefully examined into each case and made conclusions that are substantially founded.

Dependent Upon Others.

But there are few establishments that depend entirely upon their own transportation departments. With rare exceptions these are more or less dependent upon other facilities, and generally the shipping is in charge of a shipper who is expected to be responsible for delivery. He utilizes whatever services are at his command, and while he may have no voice in purchasing equipment, other than making recommendation, he is expected to produce the largest possible results with the least expenditure of money.



The Houghton & Dutton Store Garage and Loading Department, the Shippers Handling the Goods for the Two Electric Wagons—This Is the Only Shipping Room in a Store Building in Boston.

Entrance to the Garage and Shipping Room of the Houghton & Dutton Store from Ashburton Street—Climbing a Run the Department is on the Third Floor from the Tremont Street End of the Building.

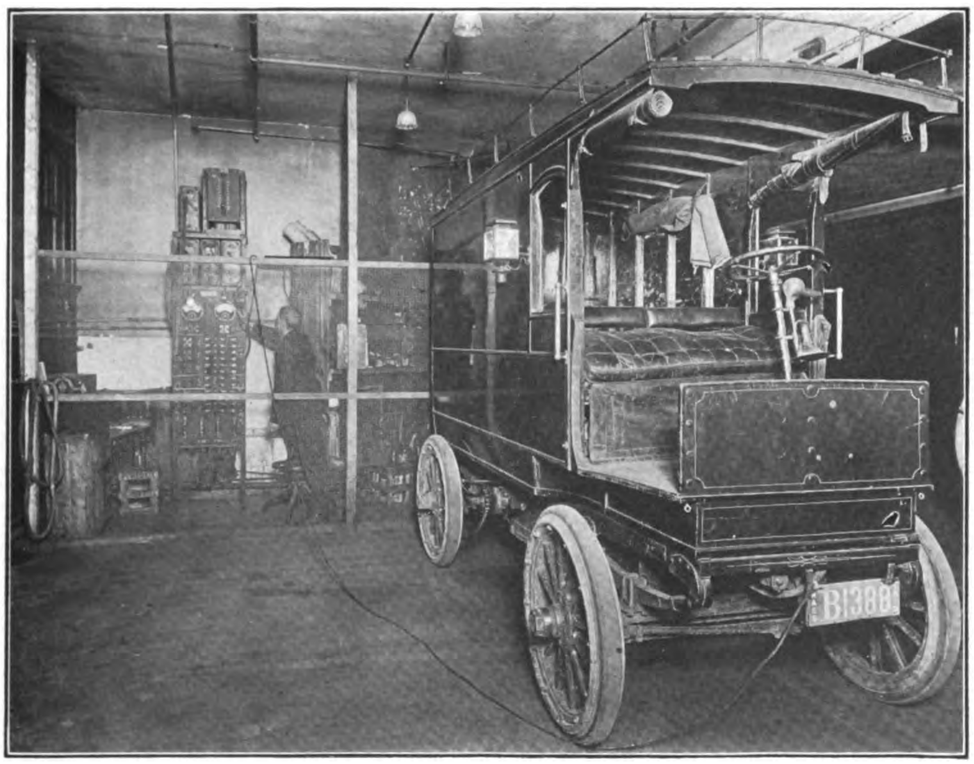
must receive its stock and make its deliveries, though there are cases where selling representatives have stock shipped from factories, shops and mills that are not handled by them, these shipments going direct to the buyers and being either hauled by him or are delivered to them. All business men do not haul their receipts of stock, and while a comparatively larger number make delivery, a considerable part is handled by concerns that specialize in this work.

Factor of Advertising.

Then primarily the problem is whether or not it is economical to maintain a transportation equipment. If there is sufficient work to justify this then the question is the character of vehicles to use. Theoretically no man ought to consider utilizing any form of conveyance unless it is profitable to do so. There are thousands, however, who regard the movements of a vehicle in the streets as having an advertising value. This factor is worthy of consideration, but strange as it may seem no charges are made against advertising appropriations and no credits are given the delivery expense accounts for this service. While with some concerns the actual cost of maintenance is considerably increased through the necessity of maintaining the appearance desired to secure the greatest benefits of highway advertising, no valuation is placed upon this appearance and the delivery department is charged with this expense. As a matter of fact there should be a revenue credited for this appearance.

Though it may be believed that this advertising factor is of small importance, there is no question whatever that some firms regard it sufficiently to pay what may be regarded as large prices for it. Some have developed business in localities from which patronage was not drawn by having their vehicles driven through the streets, and making no announcement whatever, depending upon the people observing the wagons to accept the fact that delivery would be made, and inaugurating services without custom, or a very limited demand. This has been done repeatedly by metropolitan stores in cities and towns many miles distant with excellent results.

Returning to the primary problem, that of maintaining a transportation equipment, the volume of haulage in receipts from differing sources at the expense of the firm and the volume of stock that must be delivered is the basis for determination. Stock is bought either f. o. b. or delivered, and in any event the haulage cost must be paid. Freight must be hauled and express may be either prepaid or collect, but the charge for expressage is included in the selling price. Where stock is manufactured locally it may be delivered, but here again the item of delivery cost cannot be avoided.



The Electric Garage and Charging Station in Connection with the Shipping Department of the Houghton & Dutton Store, the Panel and Stock Room Being Behind the Wire Partition.

Avon Street, Between the Main Store (at Right) and the Annex (at Left) of the Jordan, Marsh Company, Looking Toward Washington Street, Showing the Awaiting Vehicles of the Customers.

creased business. So far as attracting the public by advertising is concerned, this applies to the retail shops and stores, and generally these are the large establishments, for the most enthusiastic publicity advocate will admit that the proportion of those doing business who can be classed as local advertisers is small, and the non-advertisers are generally those whose business is limited because of innumerable reasons.

As has been stated, the transportation equipment of a store or shop is necessary only when it can be worked to realize its full value. But there are equipment units to be considered and the question is always to provide for the requirements in excess of one unit and not sufficient for another. Generally speaking such excess is provided for by such service as may be maintained by others, and this paves the way for the local carriers, which are classed as expressmen.

Then if the proportions of the business warrant the haulage can be done at less expense than for contract or intermittent service.

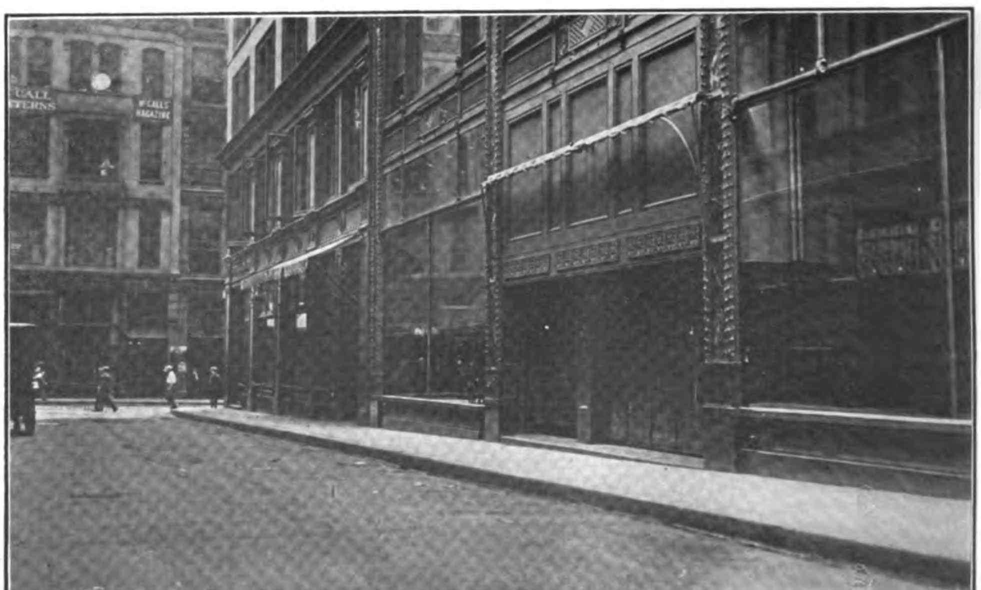
Location Is Important.

In the eastern cities of the country, where the business sections have been generally developed in the older parts of the communities the streets and highways are usually narrow. The new sections have much better planned ways, but business houses and manufacturing establishments cannot be changed because removal would entail large expense for construction and equipment, transactions would be interrupted, and there would be in all probability longer haulage. The location is a very potent factor in merchandizing because of the means taken to attract purchasers, for it will be acknowledged that advertising is a mighty influence with the public and the disposition of every person is to secure the greatest value or quality for the price paid. While it will be admitted that this statement is applied specifically to department stores, it is also a fact that the most successful business houses are those that are widely known, and reputation and prestige is proportionate to public knowledge.

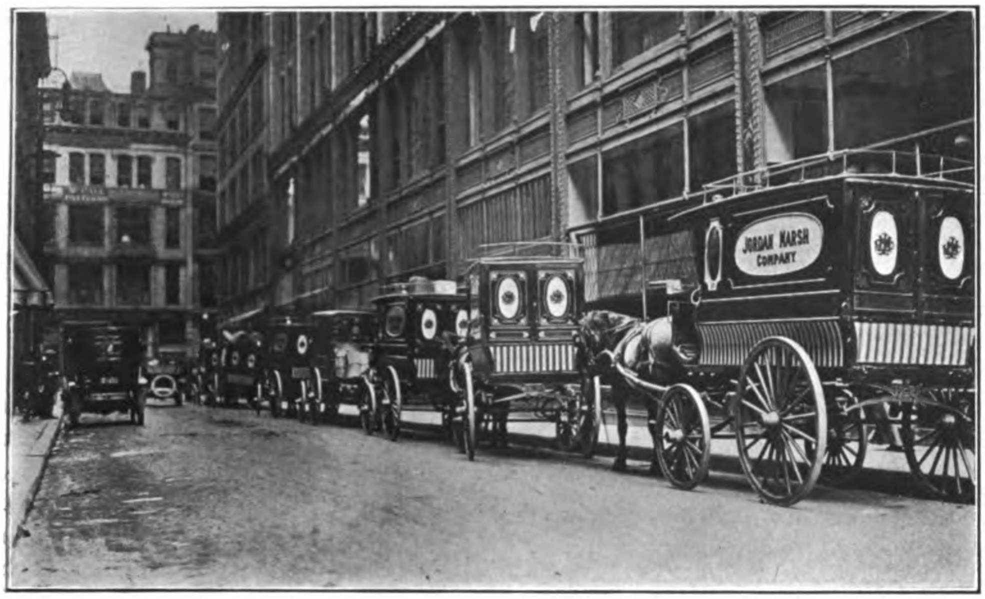
The public has been educated to buying at what are believed to be opportunities, and so much are these "sales" regarded by the people that an announcement will influence thousands to "shop" and perhaps purchase heavily, where the concern with goods and prices equal and undoubted reputation would realize no in-

Necessity for Delivery.

There are thousands of shops that do exclusively a locality business, where the goods are carried away by the purchasers, or occasionally packages are sent out by messengers or by expressmen. The larger the volume of transactions the greater the number of deliveries. Dealers in bulky goods must of necessity make deliveries and such concerns must either have transportation departments or have the work done by contract. Competition of business houses impels delivery of goods, this being a convenience that is always ap-



Avon Street, Looking Toward Harrison Avenue, Showing the Two Main Delivery Doors of the Annex of the Jordan, Marsh Company (the Second Beyond the Second Window in the Illustration) Where the Greater Part of the Delivery of Packages Is Made to the Wagons.



Line of Horse Wagons in Avon Street Awaiting Loading at the Two Delivery Doors, Which Are at the Sixth and Seventh Wagons.

preciated. Some firms will deliver any purchase within a definite radius and will ship by freight, express or mail with the charges prepaid anywhere in the United States when the purchase is or is more than a stated amount. Others will deliver packages within a radius of from 75 to 100 miles the morning following the purchase, with their own or by special service.

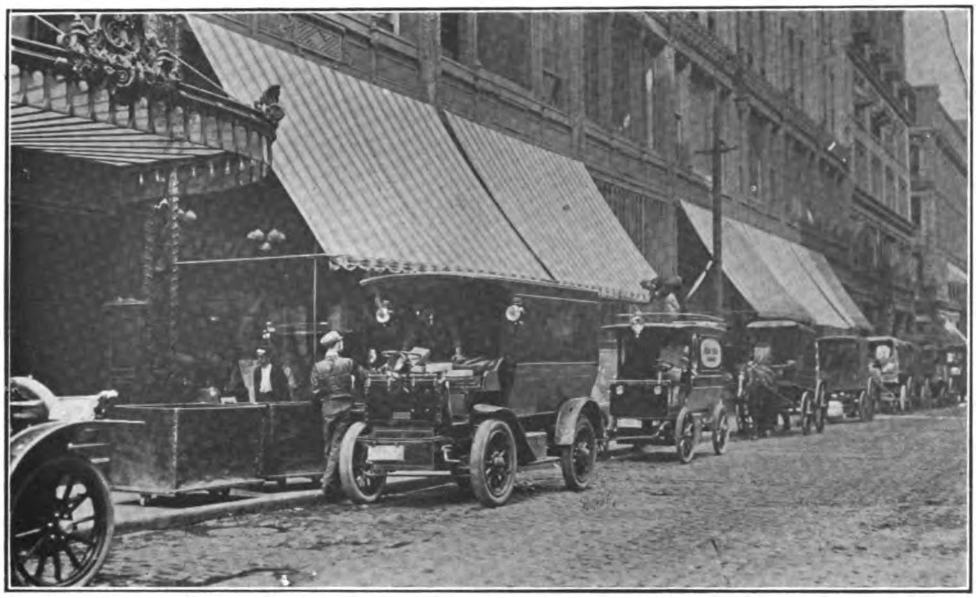
Taking as an example the store or business house that maintains delivery equipment, there is a limit to the area in which this service is practical, and beyond this it is necessary to send purchases by freight, by general express companies, by the local express companies, or by mail. In some commercial centres the street or highway railroads have developed special transportation service that is incidental to passenger traffic, but is advantageous because of its quick deliveries. This form of service is not available in all localities, but wherever it has been inaugurated it has been given excellent patronage because of the cheaper rates and the fact that it is competitive with other carriers.

Parcel Post Service.

There are express companies that specialize in transportation between different points, generally two cities, which will afford better rates for goods than will the general express companies, and these frequently develop substantial patronage, and it is often practical to have equally as fast service from such concerns. In addition to this is the parcel post branch of the postal service, the charges for which are more carefully graduated as to mileage and weight than are those of the corporations or private services. The parcel post package is delivered at the postoffice, it is dispatched on a fast train, it is sent out with the regular delivery at the office where received, and it is handled with the same care that is given to any other form of mail. The advantage of the parcel post is evident, but there are limitations as to weights and sizes that will be accepted. The packages sent by parcel post are generally paid or charged sales, but the government service will give the same attention as the express company, making collection and return of the money in the event of C. O. D. or goods sent on approval. This fact makes the usefulness of the parcel post service to the business man but slightly different in character than that afforded by the express companies. There are advantages obtaining with each form of service that are not possessed by both, and under certain conditions either may be especially desirable. Then there is a place in the mind of the business man for both express and parcel post service, and the governmental department has accomplished what is especially desirable for both seller and buyer, the termination of the monopoly of the express companies so far as the transportation of comparatively small packages is concerned. But beyond the weight and size of package carried by parcel post there has been no change other than a probable improvement of the corporation service.

Within the last 15 years motor vehicles have been used, but for more than a decade they had been regarded as experimental and of doubtful value, and it

Loading the Wagons of the Jordan, Marsh Company from the Sidewalk of Avon Street, the Packages Being Handled from the Carriers on the Narrow Walk.



Loading the Automobile Wagons at the Bedford Street Side of the Annex of the Jordan, Marsh Company, the Delivery Door Being Under the Last Awning Seen.

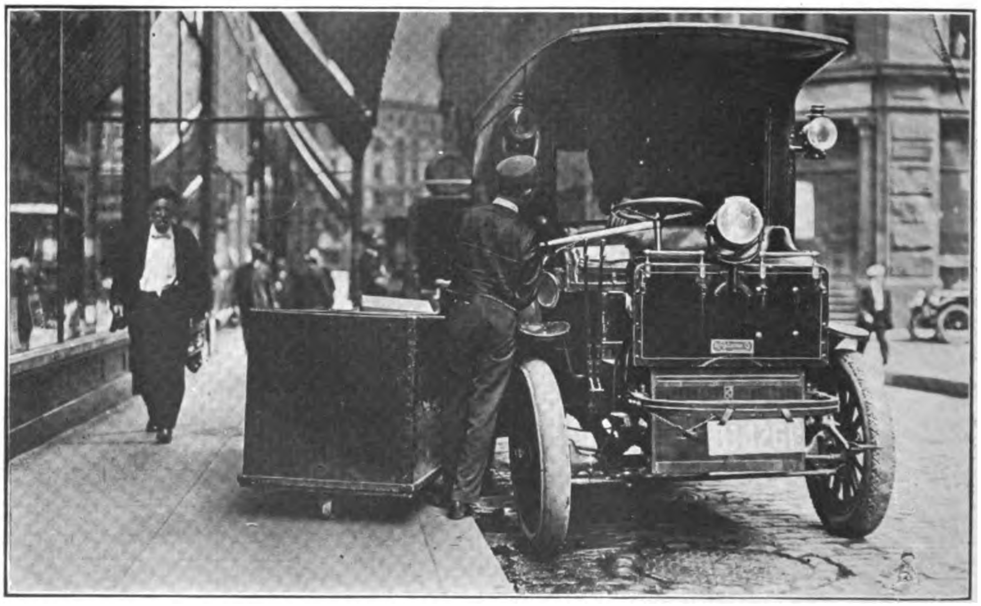
may be said that prior to 1910 there was but little known as to their actual economy. Even today the percentage of those who have accepted as established fact the real utility of the motor wagon or truck is very small, and when very careful estimate is made in differing localities it will be found that many who are now using such vehicles have no real knowledge of their economies. Not only this, there is no endeavor to learn methods or to adopt systems by which savings can be made, and there is no really beneficial result obtaining to the business world through the use of those now in service.

Road Conditions.

The horse has been the universal means of road transportation. Though mankind has known for ages that it is easier to walk in smooth and level ways than on rough paths, the disposition has been to neglect what will benefit all. Passing from man to the animal the same principle applies,but only within a generation has there been a systematical endeavor by the states to improve roads. City and town streets have been paved or graded because of the known economy, but despite the enormous cost of haulage comparatively little has been done as yet toward the betterment of the roads. The actual value of the improved road has been understood for centuries. The highways of Europe are decidedly better than those of America because they have been used for hundreds of years, and yet the main avenues of travel from the time of the Romans to today have been developed through military necessity rather than from the commercial possibilities. Commercialism has always accepted the line of least resistance and in this nation of magnificent distances railroads have been the solution of transportation when water was not available for inland communication.

In America civilization has followed the railroad, and in the greater part of the United States while the future has been planned for in communities developed within the last half century, and the city and towns streets are wide, these thoroughfares have not always been improved, while in the surrounding country roads have been developed from cart paths, and, aside from the main connecting highways, are seldom suited for economical traffic. There are those who will maintain that the statement as to roads cannot be well applied in the older sections of the country, but as a matter of fact the proportion of unimproved highway contiguous to cities of large proportions is astonishing when known.

The use of animals in transportation has been accepted without question. Animal vehicles were the alternative of manually moved carts, and horses were used because of their speed, though not as enduring or as powerful as bullocks. The main object sought was saving of time. With the limitation of the horses known the vehicles were improved. Next, some attention was given to roads, and in some instances these were made smooth, if not wide and level. Until the practical utility of the automobile for pleasure purposes was demonstrated the possibilities of road haulage were not considered, though experiments were



Sorting the Packages from the Carriers on the Sidewalk of Bedford Street at the Annex of the Jordan, Marsh Company, This Being the Usual Method of Handling the Goods.

Line of the Ford Automobile Delivery Wagons Used in the Suburban Service of the William Filene's Sons Company, Looking from the Receiving Door in Hawley Street Toward Summer Street.

made by those who realized but little of the advantages of the machines.

Animals have been used for haulage because nothing better was available. This is applied from the viewpoint of practicality. No effort is made by the average business man to determine the actual cost of animal transportation. The faults and limitations of the horse are well enough known, but animals have been utilized without the same attention to expense that would be given to any other detail of business administration. Or perhaps it may be better said that animal vehicle transportation has been accepted as satisfactory and economical from the fact that this was seemingly sufficiently proven by its use by innumerable concerns.

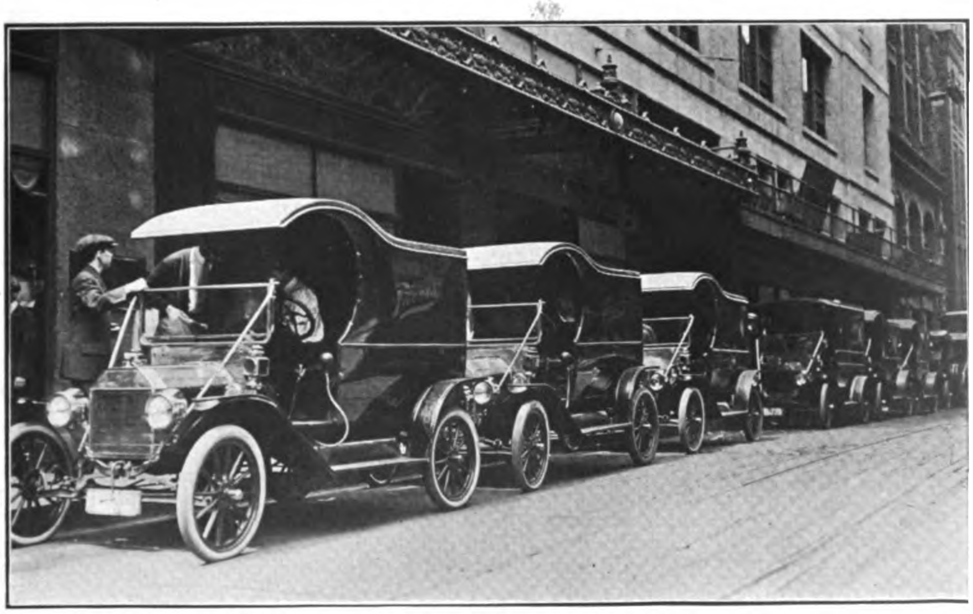
Comparison of Expense.

Considering horse expense for a moment it can be stated that there is hardly an instance where the record, if kept, has been of work accomplished and the cost of a definite unit established. To illustrate: The record may show the daily cost of a given vehicle, it may give it for the week, the month or the year, but there is nothing that will indicate the exact price of a unit of work, either on the basis of mileage, tons carried, ton-miles, package or any other practical standard. Not only this, animals vary in capacity, and while it is not practical to show what each, or each vehicular unit, has done, it is reasonable to find an average. But instead of having information of this character the assumption is that daily cost of an animal vehicle is definite. Nothing could be further from the fact. It may be that the work is exceedingly variable and that the expense will differ widely from time to time, or it may be nearly uniform. But the work is computed on a basis of so much vehicle expense.

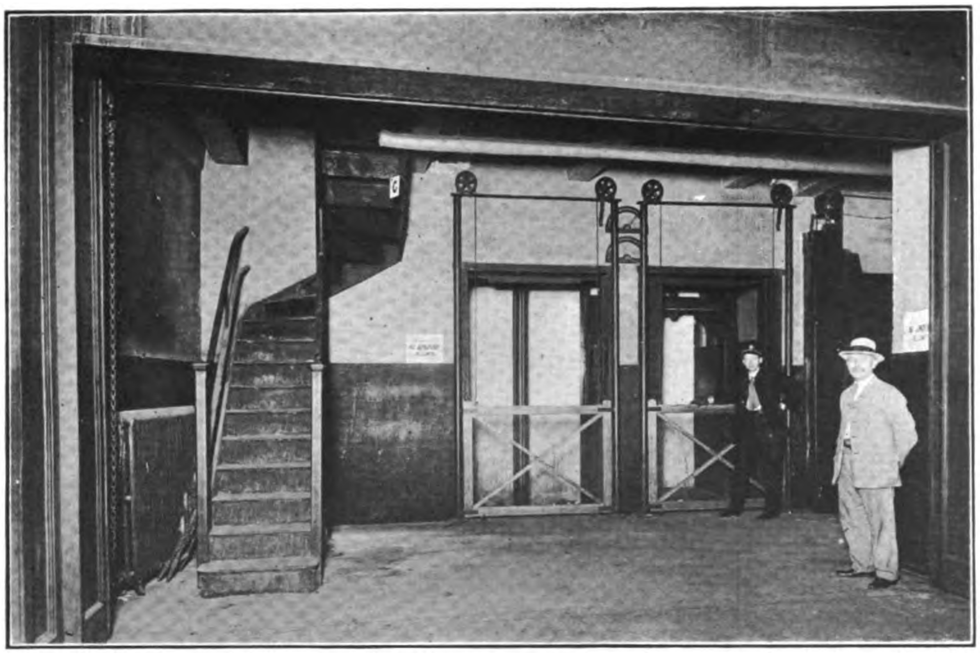
Until the need of comparison of animal and motor vehicle costs was realized this determination was satisfactory. But here the owner demands the expense of the motor and assumes that the daily basis will give him the required information. He understands that the motor has greater capacity and speed, but he has no facts relative to the cost for each unit transported. There is the difference of expense of the two forms of vehicle, but this should be proportioned. Only by so proportioning the cost can delivery expense be ascertained, and this will afford specific data, from which intelligent deductions may be made.

The lack of a definite measure for work (no matter what the standard may be so long as it will adequately represent the desired fact) makes necessary the comparison by daily cost, and this is misleading to even the expert. It is the custom in industry to measure production, and the merit of the method, system or means of producing is established by this measure. The logical value of transportation is represented by work, and the cost of this work demonstrates the economy of the vehicle used.

It is exceedingly difficult for the truck salesman to approach a business man with the general statement of motor vehicle efficiency and convince this man that he can economize, advertise and extend his patronage through the use of machines. The best informed sales-



Loading the Suburban Delivery Wagons at Filene's Store from Carriers and with Packages Brought from the Shipping Room by the Drivers and Helpers.



The Shipping Room Elevators at the Hawley Street Side of the Filene Store, by Which All the Packages Are Brought from the Second Sub-Basement.

ly influence others. Equality of service is not sufficient.

There are always lines of demarcation when economy alone is considered. The delivery of any business is variable and there is seldom an instance where the same volume of haulage is maintained. Not only that, there is the element of unproductive mileage of vehicles that must be considered. Were it possible to have the distribution from one end of a route to the other, the problem would be exceedingly simplified. This, however, is seldom practical. Considering economy solely, there is a limit to any area wherein delivery can be made, but the equipment is a material factor. To illustrate: If the saving is of time then the main consideration is speed, but if it is cost without reference to time, then the limit may be considerably extended for the same expense. Usually both time and cost are combined and this is the aspect from which delivery is regarded.

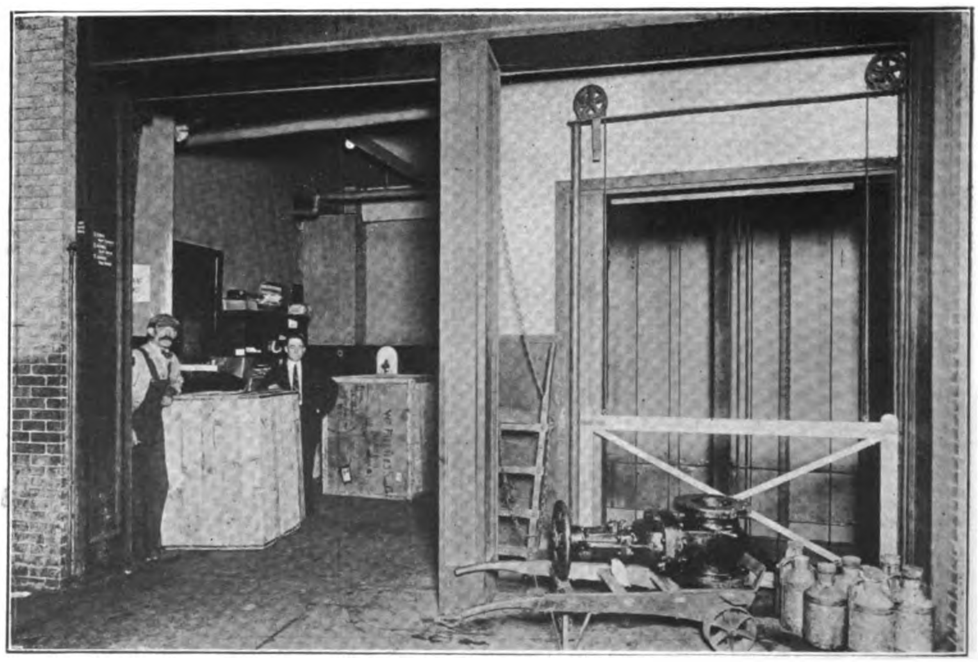
It might be put another way. If business depends upon delivery within a specified time a special vehicle or a special messenger may be considered, or possibly the regular service will suffice. If the third form named will meet requirements it is undoubtedly cheaper than either of the others. If, however, the delivery can be delayed until there is a sufficient volume to send it by a vehicle assigned to this particular work, or it can be carried by a service that specializes delivery in this section, the saving is apparent. People, however,

man may have his own ideas of the possibilities with vehicles as demonstrated in other conditions, but this does not mean that similar results can be realized in the particular case under consideration.

Factors That Determine Economy.

It is evident enough that volume of business transacted is a potent factor. The same laws that apply to business generally may be applied to delivery, and the store or shop or works that has large equipment generally has better facilities, system and organization, all of which contribute toward the economy of haulage. The expense of distribution in one locality cannot be paralleled in another, and the variance may be material. Conditions may be such that one could not expect to equal the showing in another city. The factors that have a bearing are numerous. They include first of all overhead expense, then administration, character of equipment, facilities for operating, capacity of employees, the topography of the community, the condition of the streets, the wages paid, the quality of upkeep and maintenance, the prices for supplies, and the requirements of the service.

But beyond all this is the demand of the people, which is generally resultant from competition. A service that might be adequate and meet with every requirement in one city will be decidedly insufficient in another. Those who desire to attract custom have policies to maintain with reference to prices, qualities, delivery and attention. These will natural-



The Elevator for the Receiving Department of the Filene Store, Reached from Hawley Street, Not Used for the Delivery of Goods.

The Main Delivery Door of the Shipping Department of the Store of R. H. White & Co., in Norfolk Place, Close to Harrison Avenue.

that enter into the problem, and before the requirements of the individual business can be intelligently considered it is first necessary to understand the locality conditions. There are admirable examples of transportation organizations existing in comparatively small establishments, and these have been developed with reference to the economies within the control of those administrating them, but not to the realization of the greatest saving. To save from every possible viewpoint might mean the utilization of some of the other services available, but this could only be accomplished at the expense of the convenience of the patron.

have become accustomed to demanding that a purchase be delivered as quickly as is practicable after it has been sold, and this impels the maintenance of a service that will be sufficient to meet these demands. In other words the general policy of the business house today is to send out at frequent intervals the deliveries for any one locality, and at speed to satisfy the most exacting. Perhaps it may be best put by saying that competition forced a fast and necessarily expensive delivery to serve those who were first a small proportion of the patronage, and as the advantage of the quick delivery was realized there was no reason why it should be rejected.

Service Must Be Paid For.

Turning to fundamentals for an instant, it is unquestioned that this service must be paid for. Without doubt all the costs are added to the stock prices, and theoretically each dollar's worth of stock sold must pay its proportion of the delivery expense. There is, of course, more or less of the sales taken from the stores by the customers, but while this varies exceedingly it can be said that the ratio of customers that carry home their purchases is constantly growing smaller. In the accounting the total cost of the delivery expense is charged against receipts. But the customers, for the convenience of delivery, are willing to pay, and the expense is dependent upon many factors.

The general principle of delivery appears simple. In theory it is merely removing commodities from the one point to another by the cheapest and most practical manner, but there are innumerable factors

Few have even a vague knowledge of the ramifications of the general subject of transportation. The first city to which attention has been directed is Boston, and this because it offers one of the most complex problems of the nation so far as haulage is concerned. The investigations were directed toward every available form of common carrier that can be employed, and while department stores were the basis for inquiry the survey naturally was to all forms of industry and commerce in which road vehicles are used. Just what proportion of the transportation facilities can be motorized is uncertain, for much will depend upon the attitude of the owners or those controlling them. It is certain, however, that there are innumerable opportunities for the use of motor vehicles because of the peculiar and unusual character of service demanded. The interests of the different transportation companies impel the improvement of service when this is possible, and competition demands that there be the greatest measure of economy it is possible to secure.

Harrison Avenue Extension at the Rear of the Store of R. H. White & Co., the Main Receiving Entrance Being Under the Awning, Partly Concealed by the Truck.

BOSTON'S EXPRESS AND STORE SERVICES.

EVERY locality has its own peculiar conditions with reference to transportation, a statement that applies equally well to the service afforded by railroads or steamers for freight, by express companies doing general or sectional distribution, by those doing similar work in several communities, by those confined to a single community, and by the individual business firms.

These conditions are the result of business requirements, without question, but the services have been developed without consideration of the possibilities of economy. Business competition has prompted promotion of haulage concerns, each having at inception a specific work, and it is but natural that those promoting them have sought to extend the scope of their activities and the volume of transactions. As the communities have increased demands have impelled the establishment of service to meet existing needs, and these have been developed to widely differing proportions.

Winter Place, Looking from the Steps of the Building at the End Toward Winter Street, Where the Shipping and Receiving of the Shepard-Norwell Company Is Done.

Boston is the commercial centre of New England and it is the second largest shipping port of the nation. It is surrounded by a large number of cities and towns, from which its business is drawn, and it is, broadly speaking, the purchasing place for a population that can be estimated as close to 1,500,000, while within a radius of 60 miles are no less than 3,500,000 people.

The Business District.

Boston attracts to its markets people from a much larger area than is included in this 60-mile circle, and this statement can be generally applied to every need aside from fuel, food and raw materials for manufacturing. Because of obvious reasons business houses have been established in the section of the city close to the water front and the railroad terminals, and, as is usually the case, those dealing with a special product are close together. The wholesale district of the city is that part first settled, when streets were originally paths and then roads, there being no thought given by the Colonists to the requirements of the centuries to come.

The retail stores and shops have been for a century located in Washington and Tremont streets and the thoroughfares between them, and in this section of the city these establishments are so well entrenched that there is little probability that they will be removed, though experience would justify the supposition that there would be a general retreat of the retail district before the demands of the wholesale division of business. This has been the inevitable result in other cities, and there would appear to be no reason to expect anything else in Boston were it not for the fact that passenger transportation systems and facilities have been developed with a view of meeting the requirements of the people with reference to the present locations, and change could only be made at enormous cost. In fact the expense of a change would be practically prohibitive.

Boston from the viewpoint of the transportation student is peculiarly located. The water front is utilized in every sense and the shipping requirements have impelled the building of two stations as terminals for the New Haven and New York Central lines, which control all the railroads centring in the city, and the freight yards are adjacent to the passenger stations. It is desirable for the retail business men to be located as closely as is practical to these stations, and as it now is the retail stores are comparatively near to them. This statement is applied especially to the department stores, where immense volumes of business are transacted annually, and to which people are drawn from all parts of New England. While it is true that there are thousands of stores and shops, and the business has extended along the main thoroughfares in every direction, these are more or less dependent upon locality patronage. There is also a class of specialty shops and exclusive stores, where the custom is limited because of the character of goods carried. It is no exaggeration to say that there are more of such specialized goods in Boston than in any other city of similar or even larger proportions in America, for Boston is an extremely wealthy community and the people demand a greater ratio of special products.

The City Proper.

The old part of the city in which the streets are narrow and where there is very generally congestion

Sidewalk Elevator in Winter Place on Which Is Carried Practically All the Goods Shipped or Received at the Store of the Shepard-Norwell Company.

stretch from the Quincy line to the western Brighton line is about 9.5 miles. Brookline, which is said to be the wealthiest town in the world, is nearly surrounded by Boston, its people having rejected all proposals for annexation to Boston because of the difference in taxation.

The Metropolitan Section.

What is regarded as the metropolitan section or district is practically the area contained within the 10-mile circle, and this includes the cities of Cambridge, Chelsea, Everett, Lynn, Malden, Melrose, Quincy, Somerville and Waltham, though Lynn is not generally included in this designation, and the towns of Arlington, Belmont, Braintree, Brookline, Canton, Dedham, Lexington, Medford, Milton, Newton, Needham, Revere, Saugus, Stoneham, Wakefield, Watertown and Winchester. It will be noted, however, that this circle does not take in all of these towns and in several instances the greater part is outside of the circle. In all there are 27 towns and cities within or touched by this circle.

Outside of this circle and included in the same manner in a radius of 15 miles from Boston Common is the city of Salem and the towns of Bedford, Burlington, Cohasset, Danvers, Dover, Hingham, Lincoln, Lynnfield, Marblehead, Natick, Norwood, Peabody, Randolph, Reading, Swampscott, Wayland, Westwood, Wellesley, Weymouth, Weston and Wilmington. The map also shows outside of this 15-mile circle the city of Beverly and the towns of Acton, Billerica, Carlisle, Concord, Framingham, Holliston, Medfield, Scituate, Sherborn and Sudbury, but these are not all of the

of traffic, may be said to be east of Charles, Berkeley and Pleasant streets, and Broadway extension. This does not include some portions of South Boston, East Boston and Charlestown. West and South of this area the streets are not only much wider and better laid out, but there is not the extreme use made of them. In the older portions of Boston are all the wholesale and all of the large retail stores. There is in the West End, so-called, and the section along the water front, a considerable foreign population, where there is comparatively little demand for delivery of goods, but aside from this in all of Boston and all of the towns and cities surrounding it there is need of delivery that is more exacting than in any other city in America, if not in the world.

This statement will, no doubt, be debated by those who believe that the demands made upon them are excessive, and that they are required to insure to their patrons service that will satisfy them, but when the conditions in other cities are carefully analyzed it will be found that the Bostonians have been educated to expect from the business houses services that cannot be equalled in the world.

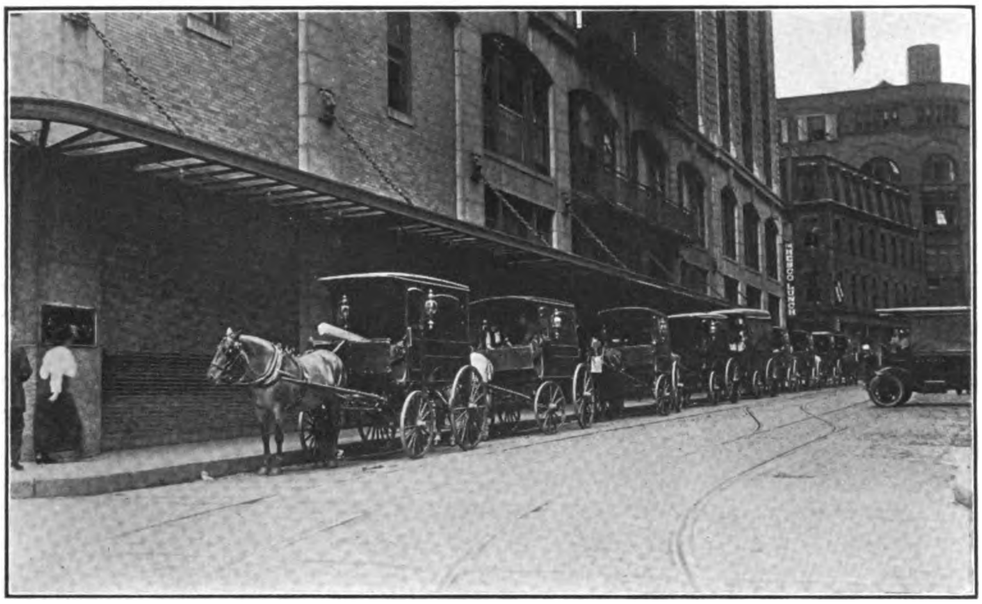
Boston, as will be noted from an accompanying map, which shows in outline the location of 12 cities and 49 towns that surround it and the approximate distances by circles indicating mile zones, is practically 11 miles long, extending from the mouth of the Charles river inland, and including Charlestown and East Boston on the north of the Charles and the harbor the length is nearly 14 miles. The greatest width at the southwest or inland end of the city is six miles, but the

Receiving Entrance of the Store of the Henry Siegel Company at Essex Street and Harrison Avenue Extension, from Which Some Stock Is Also Shipped.

municipalities included within the 20-mile circle. Less than half the number in this circle are shown, so it can be stated that within this radius of 20 miles are no less than 75 cities and towns. The population is approximately 2,000,000 people, and for this number Boston is the regular place of purchasing.

The Transportation Facilities.

These towns and cities are the places of residence of many thousands who do business or are employed in Boston, and the demands of these people have brought about generally adequate transportation, either by steam or trolley railroads. In these towns and cities are substantial and progressive industries, some of them of very large proportions. These communities patronize the local stores for household supplies and for more or less of other necessaries, but a considerable part of the buying is done in Boston. Boston is the distributing point from which a large proportion of the supplies of stock for these stores and factories is sent out, and it is again the collecting point from which a large part of the manufactured products is shipped.



Delivery Wagons of the Henry Siegel Company in Harrison Avenue Extension—the Main Delivery of Parcels Is from the Entrance Under the Fire Escape.

From Boston in every direction inland or along the coast radiate steam and electric railroads and there are numerous steamboat lines that are operated a part or the whole of the year. There are direct water lines between Boston and the principal cities of the coast, and, of course, the steamship lines that afford regular service between the large ports of the different countries of the world. Large volumes of raw material of all kinds, fuel, and the like, are received at Boston and distributed from that city by rail lines. New England is largely given over to manufacturing, and agriculture is incidental at best. The logical distribution of the manufactures is throughout the country and this means that the great bulk of all products is sent West, and the receipts are received from the West and South. Thus in the natural course of events there is the shipment into and out of New England, this affording carriage two ways, which insures to the railroads and the big transportation companies an unusually large volume of business.

But it is with the inter-town and inter-city transportation that the highway vehicle has its special value. Just what radius of delivery is most economical depends upon circumstances and conditions. In the absence of railroad competition and the high rates charged for freight is the hope for the utilization of motor wagons and trucks, although there is another element that must be considered, and that is the express companies. There are those who will maintain that the individual service is the most economical, but the volume of haulage is a decidedly important factor. It is this exceedingly large work that has given Boston what can be regarded as the equal of any local transportation of the country, if it is not the best in the world. There is no better demonstration of the value of competition and monopoly than is to be found in Boston, for at the one hand is the remarkable delivery service of the expresses and the stores, and at the other is the excessive high rates charged for freights by the railroads. Not only this, but it is common knowledge that it costs more to send freight out of New England than it does to bring an equal volume of commodities or raw material into these states.

The Department Stores.

In considering vehicle transportation in Boston the department stores have been made the basis of the investigation from the fact that the demands of the people have been with these concerns unusually exacting and the radius of delivery is unrestricted within New England. There are a half dozen companies that may be regarded as conducting large establishments, and there are a considerable number of others that will be placed in the same classification, though transacting less volume of business. Of these the largest is that of the Jordan, Marsh Company, which is known throughout the country as one of the representative firms of the nation, and there are others that are hardly less known. These include the William Filene's Sons Company, the Houghton & Dutton Company, R. H. White & Co., the Shepard, Norwell Company and the Henry Siegel Company. Of these the Jordan, Marsh Company is the oldest and next is the Shepard, Norwell Company, the Houghton & Dutton Company, R. H. White & Co., the William Filene's Sons Company and the Henry Siegel Company, the last named being established about eight years ago.

Of these the store of the Houghton & Dutton Company is maintained to be the original department store

Sidewalk of Harrison Avenue Extension, Looking from Hayward Place Toward Essex Street, Where the Packages Are Loaded by the Wagons of the Henry Siegel Company.

in America, it being established in 1872, one of the firm having been associated with R. H. Macy in New York and organizing the firm of Houghton & Dutton, which departmentalized its store, and from which origin has developed the thousands of establishments conducted along similar lines in this country and, perhaps, abroad. The Houghton & Dutton Company's store is at Tremont, Beacon and Ashburton streets, at the east base of the historic Beacon Hill, and directly opposite the famed old King's Chapel. The store of the Shepard, Norwell Company is between Washington and Tremont streets and extends from Temple street to Winter street, with Winter place, a narrow court, along one side. This court extends about half through the block and there is a foot passage through a building by which pedestrians may go from Winter street to Temple street.

The store of the William Filene's Sons Company is at Washington, Summer and Hawley streets, this being occupied in September of last year. The Jordan, Marsh Company's store occupies two large buildings, the old structure having frontage on Washington and Avon streets, one section of which extends from Avon to Summer street; the other building occupies the eastern half of the block between Avon and Bedford streets, with Chauncey street on the east. The store of R. H. White & Co. is in the block surrounded by Washington and Bedford streets, Harrison avenue extension and Norfolk place. The Henry Siegel Company occupies the building covering the block bounded by Washington and Essex streets, Harrison avenue extension and Hayward place.

The distance between the Filene, Jordan, Marsh and White stores is that of a comparatively narrow street, and a short block is between this group and the Siegel store. There is perhaps 300 yards between Summer and Essex streets, and there is probably 350 yards between Filene's and the store of the Houghton & Dutton Company, with that of the Shepard, Norwell Company not more than 100 yards distant from Filene's. Boston Common, the State House, the postoffice and the city hall are all regarded as the point from which distances are computed, but all are sufficiently near each other to make but little difference in the result, no matter which is accepted.

Topography of Boston.

Boston, as will be noted from the accompanying map, is irregular in form and the old portion is between the Charles river and what is known as South Bay, there being an arm of the sea connecting this with the harbor that is known as Fort Point Channel. East of this section is South Boston. South of South Boston is Dorchester, and south of the old city is that section known as Roxbury. Southwest is Jamaica Plain, while west, connected by a narrow strip along the Charles river, is Brighton. There will be references made to localities that do not appear on the two maps that are included and these are designations of different parts of the towns or cities. Allston, for instance, is a section of Brighton. There are innumerable names that are thus applied and which have no significance aside from the fact that they

Receiving and Shipping Doorway of the Henry Siegel Company in Hayward Place, Where the Furniture Is Shipped and the Large Bulky Goods Are Received.

more definitely locate some parts of these suburbs.

Many years ago when the suburbs of Boston were being developed and the people of these sections wanted delivery of purchases there was no especial stress placed upon time, so the thrifty Boston merchants limited the area in which this service was given to what was then known as the "city," a designation which has been accepted and has been retained since that time. As the city has increased and some of the towns were annexed the lines of demarcation first established were preserved, and today the "city" as defined by those engaged in transportation is that part of Boston bounded by the Charles river, the water front, Fort Point channel and by an irregular line extending in a southerly and easterly direction from the Cottage Farm bridge at the Charles river, Borland street, Audubon road, the Back Bay Fens, the Boston & Albany tracks, Hemenway street and Lenox and East Lenox streets. This area is much larger than that originally defined, for less than a score of years ago if a delivery was made to Massachusetts avenue it was regarded as being well into the country. But gradually the service was extended to the east end of Brookline and to some sections a short distance beyond Massachusetts avenue.

One of the 21 Offices and Receiving Stations of the General Express Company in Boston, at 105 Arch Street, a Clearing House for Nearly 100 Common Carriers.

Traffic Regulations.

The streets of Boston east and southeast of the historic Common are very narrow, the roadways frequently being not more than 20 feet, with sidewalks perhaps five feet width, while there are innumerable alleys with room for a single vehicle between walks just wide enough for a single person. Some streets were made wider following the fire of 1872, but considering the volume of traffic there is none that is adequate for the requirements. For this reason traffic regulations make many of the streets one way only, and vehicles are not permitted to remain for more than five minutes unattended and 20 minutes attended, and in some streets they can simply stop long enough for passengers to alight or enter. The street commissioners having charge of the enforcement of the traffic regulations are seriously considering the making of a provision that all heavy vehicles shall be denied the use of Washington street between the hours of 9 in the morning and 5 in the afternoon. The effect of the ordinance has been to keep the streets clear of standing wagons and machines, but the rule is more strictly enforced with regard to vehicles used for pleasure. Thus far no real burden has fallen upon those doing business, although the enforcement of the regulation would undoubtedly work many hardships. It will be understood that the rigid enforcement of the ordinance would mean the loading and unloading of much freight at night and a complete revolution of the methods now the vogue. While this result will undoubtedly come there is no reason to apprehend any radical action that will seriously handicap the business men.

But the fact remains that the congestion has constantly increased in the streets, that the traffic regulations require longer time for doing a work because of the need of observing them, and that the only possibility of relief is in giving over the highways in the wholesale and retail districts wholly to business. When the limitations have been reached there will be no other alternative than to increase the number of hours in which work may be done.

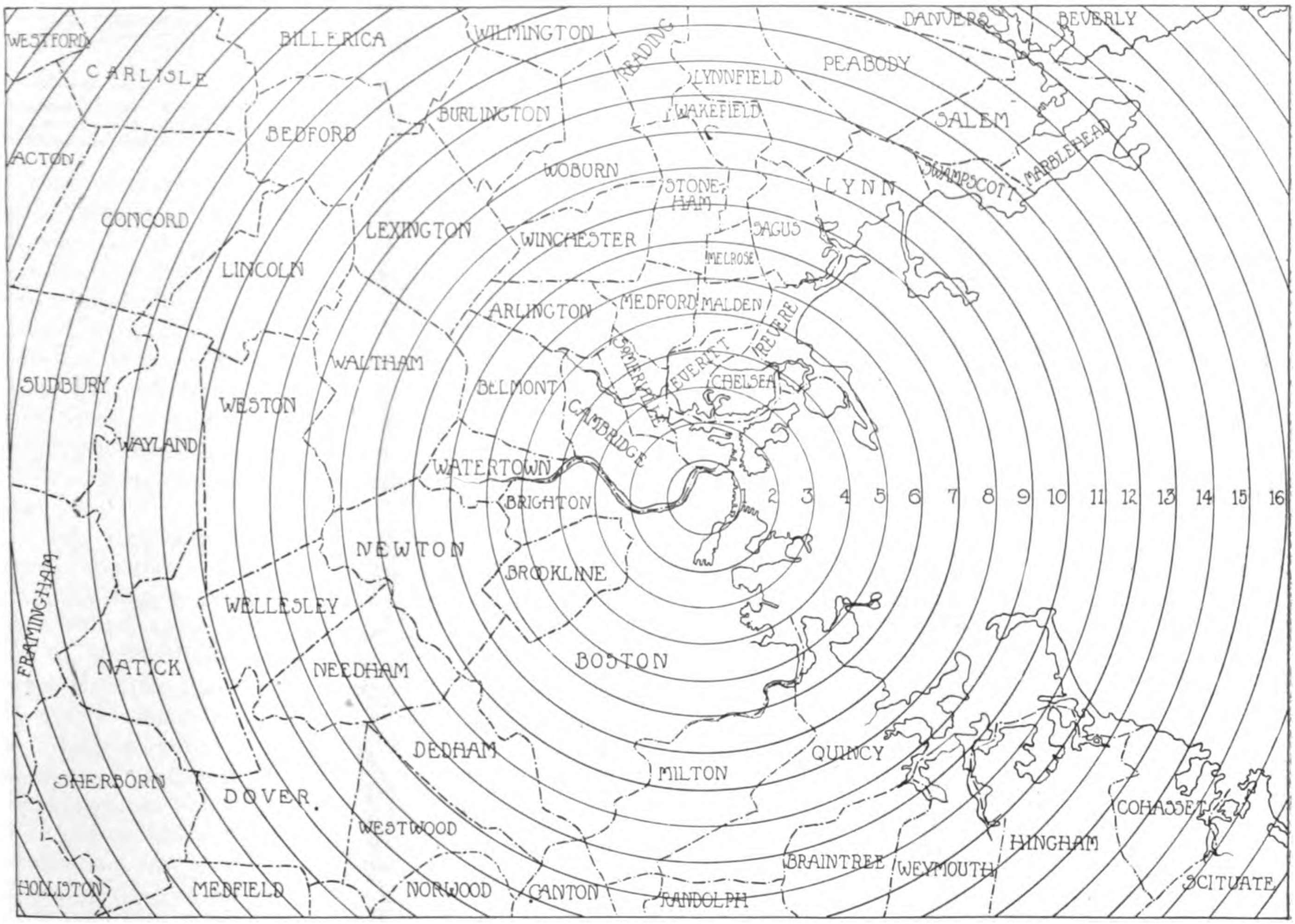
Provisions for Delivery.

The delivery of the six stores that are specifically dealt with in this article, outside of Boston and its suburban district, has practically the same basis in that any purchase valued at $1 will be delivered free anywhere within the State of Massachusetts, household furnishings excepted, to any express office, freight office or postoffice, and all purchases valued at $5 or more will be delivered to any express office, freight office or postoffice, and all purchases valued at $5 or more will be delivered to any express office, freight station or postoffice in New England. The companies reserve the right, however, to ship by express, freight or mail, as may be most convenient. If the shipment is made by freight, however, this means delivery at the freight station and not at the home of the purchaser. Thus it will be seen that any purchaser is on exactly the same basis, no matter where the place of delivery. The area covered by this form of delivery is much larger than is included in any metropolitan store, and it is probable that this service is not excelled anywhere in the world.

The delivery in Boston and the suburbs of the city, however, is an entirely different proposition, and while it is free the manner of handling the purchases dif-

fers decidedly. The furthest that delivery is made by the equipment of any store is approximately within a 10-mile radius from the stores, and a glance at the map showing the mile zones will give a very comprehensive idea of the area covered. Each store has its own system and methods of delivery, developed through experience and from knowledge of the needs of the customers, but when it is stated that the service afforded Bostonians is better than anywhere else in America the statement is made advisedly.

With rare exceptions, within the area of delivery, the customers can expect to have the goods bought up to the time of closing the stores delivered the same evening, and this is true if the customer lives within a radius of 20 miles. The outside delivery, however, is made by other agencies. But the organization is entirely within the control of the shipping departments and there is absolute certainty that the deliveries will be made.



Map of Boston and Suburbs, with Towns and Cities Included in the Mile Zones from the Boston Common, Recognized as the Civic Centre, and Close to the Principal Points of Distribution.

Delivery Equipment Available.

The combined delivery equipment of the stores consists of 61 automobiles and about 425 horses, but in addition to this there are innumerable delivery or express companies that cover the different communities which are regularly or occasionally used. There are in all 367 different express services centred in Boston, of which four are general and make deliveries throughout the country, 15 give a specific service between New England points and 343 are or may be classified as city or suburban. There are, in addition to these services, many others that do a regular business of haulage between different sections or places, as well as a considerable number that is engaged in general transportation, taking any work that may be required, for a single trip or for definite or indefinite periods.

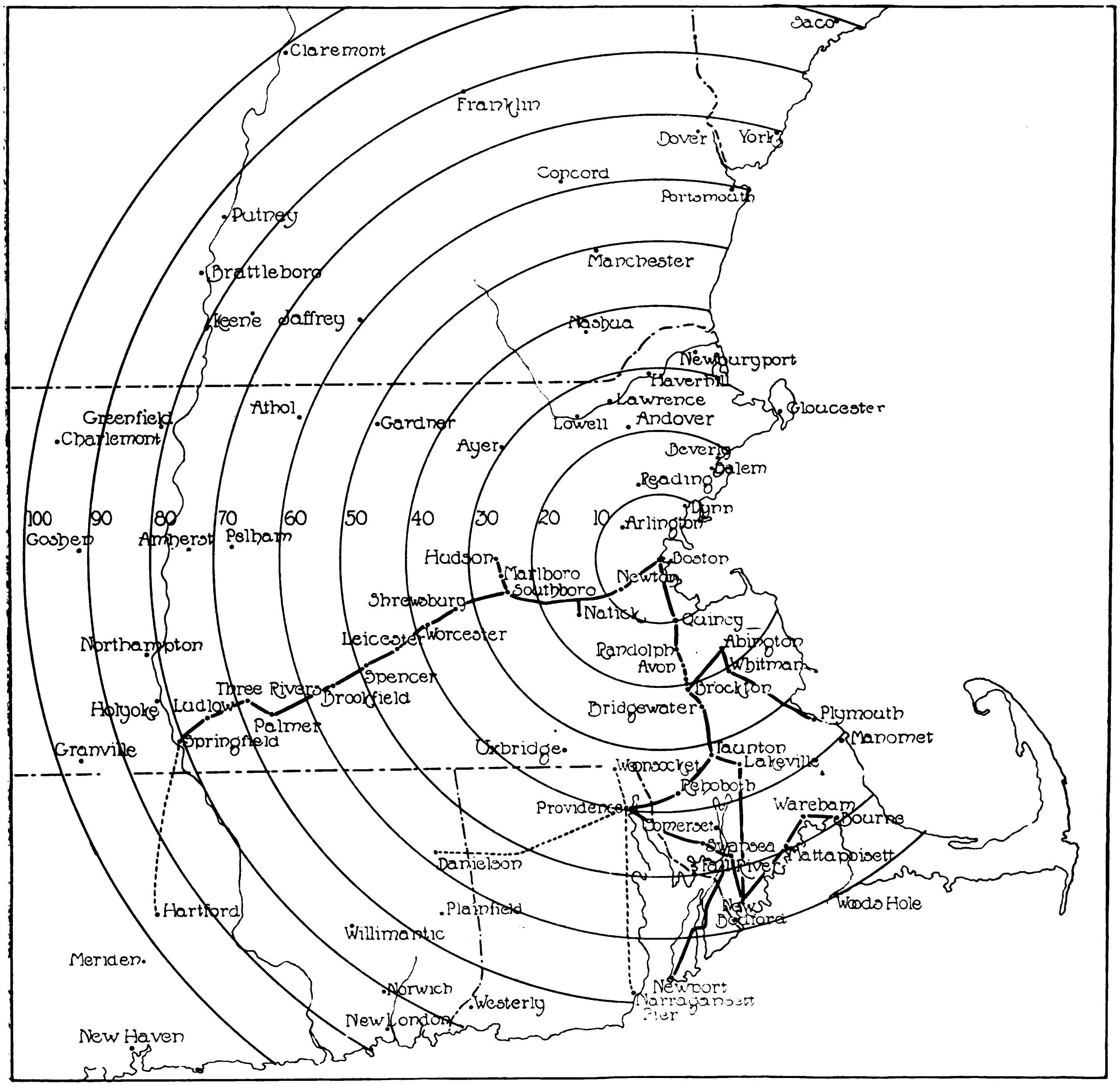
Regarding these different express companies for a moment. There is an organization of these concerns known as the League of Express Companies, which may be said to be local to Boston, maintaining its office there. Membership in this is held by the four general express companies, by about half of the concerns doing a New England business, and the remainder of the listed members consists of those who do local or suburban transportation. The league is known in Boston and the different communities where it has representation and the impression obtaining may be said generally to be that a thoroughly satisfactory service can be secured from a league company.

Whether or not there is a greater degree of responsibility attached to a service given by a league company and whether or not there is a larger measure of satisfaction insured may be debated by those who desire, but there is undoubtedly importance placed upon membership and the prestige afforded is appreciated

if not valued. The league is controlled by a directorate and this body passes upon all applications for membership. There is assumedly a disposition to limit the number of members, and frequently petitions are refused. By some the league is considered to be a close corporation in its attitude toward admitting new members. The benefits are said to be the exchange of information concerning general and specific subjects, co-operation so far as policies are concerned, agreements as to rates, services, exchange of business, and the exercise of such influences as will benefit members specifically. But it will be seen that the league companies are the minority so far as number of concerns doing business in Boston and vicinity. Of the 367 companies there are the four general companies, 15 concerns doing a New England business, two doing an exclusive freight business and three handling parcels, the parcel deliveries making a specialty of serving stores.

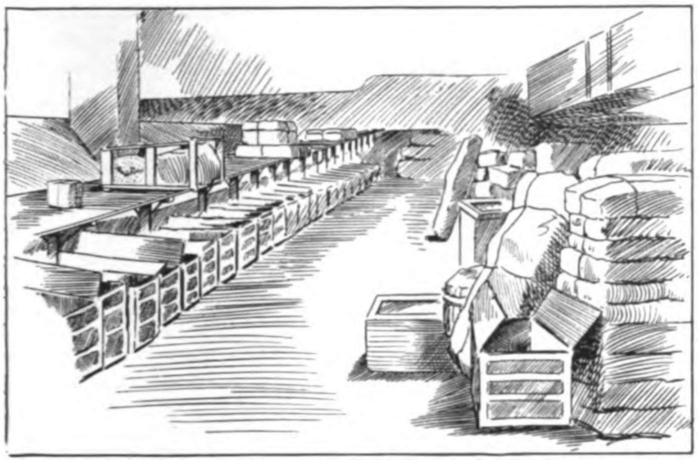
Clearing House Methods.

The General Express Company is unique in that it does not own a vehicle and yet it has 21 offices in the business section of the city. It is practically a clearing house for a considerable number of companies—more than 100 in all probability—and each station gives exactly the same service. For a stated amount a company is furnished with a small drawer in a large file case, and in some instances a compartment in a tier of bins. Packages may be left at this station for the subscriber and these are placed in the bin assigned. Call orders are received by the operator of the branch telephone exchange and these are written out and placed in the subscriber's drawer. Any information



Map Showing the Principal Commercial Centres and Their Relative Distances from Boston by 10-Mile Zones—Within the 60-Mile Circle Are 4,000,000 People, and Within the 100-Mile Circle 5,000,000—The Black and Dotted Lines Show the Electric Express and Connecting Lines and the Points Reached by Them.

relative to the subscriber's service is furnished inquirers. Calls are made at stated hours and collections made by the subscribers. This service may be likened



Section of the Shipping Room of the Filene Store, Showing Arrangement of Carriers and Stand for Large Bundles in the Express Section.

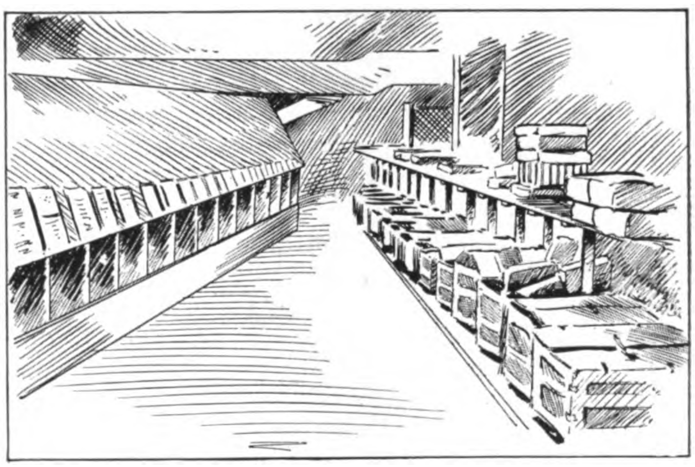
to that of a central office for each express company subscribing, and makes it possible for them to extend transient business, for this does not affect their regular customers, although it is beneficial in that it provides for an emergency service without requiring additional equipment. Not only this, but the expense on the basis stated is comparatively small for each subscriber. These offices are open from early morning until well after business hours. During the day packages and freight are received and so far as possible they are sent out the same day unless received after the last call hour.

Once each quarter a list of all the recognized express companies is published, this designating the company, its stations and the hours for calling, and this list is sold to those who desire it. It contains in addition to alphabetically arranged listing of the companies a similarly prepared list of all the towns and cities, and in some instances the postoffices or village designations with the names of each company by which that particular point may be served. This applies throughout New England. Thus to reach a given place the company that can be used can be instantly ascertained, and by reference to the companies the locations of the stations in the city and the hours of collecting may be learned. In such lists the members of the league are designated.

How Sections Are Served.

Many of the express companies afford regular service to stores and manufacturers at both terminals and accept such other business as may be offered, and the value of the clearing house method is evident when transient haulage is considered. As may be assumed, it is necessary to collect and distribute at either end of the haul and the location of the receiving stations does not by any means represent the area covered by each company. It must not be understood that there is a limited service unless in the event of some remote locality, and on this list from three to 24 different companies can be found that will make delivery in a given section. This does not mean that this applies to towns and cities only. For instance, Allston, Ashmont, Back Bay, Brighton, Charlestown, Dorchester, East Boston, Hyde Park, Jamaica Plain, Readville, Roslindale, Roxbury, South Boston, South End and Wollaston are all in the city of Boston, and from five companies in the case of Hyde Park and Roslindale to 20 in the case of Roxbury are available. Taking the immediate suburbs of Boston, 19 different companies serve Cambridgeport, 24 Cambridge, 18 Somerville, 14 Malden, 14 North Cambridge, 24 East Cambridge, 13 Watertown, 13 Quincy, 11 Revere, five Arlington, five Arlington Heights, six Brookline, 13 Chelsea, eight Everett, eight Lynn, eight Medford, five Peabody, seven Waltham, six Winthrop, five Belmont, three Hingham, three Wellesley, to say nothing of some communities like Newton, for instance, where there are six different sections each served from five to eight companies, there being no less than 16 serving the city.

Where there are so many different concerns doing the same business and covering the same areas there is enormous duplication of service, but it is also evident that the competition that has been developed is especially advantageous for the people. But this does not represent the possibilities, for most of the companies will deliver in practically any part of the city and suburbs where the work justifies and besides there are numerous store deliveries that serve the same sections. Of course it is only the store of large proportions that would undertake to make delivery within the 10-mile radius from the centre of Boston, but there are hundreds of smaller establishments that deliver within this area as well as a very heavy wholesale distribution. It would be impossible to estimate the volume of haulage by these different comapnies, and it should be understood that these do not represent all of the transportation. There is one haulage contractor in Boston who owns close to 400 horses, and there are many others who have what may be regarded as large equipment. There are numerous concerns that specialize

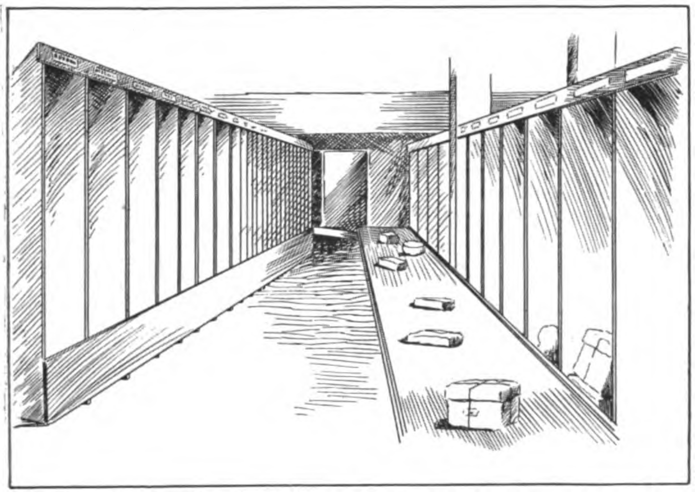


Part of the Combination Bin and Desk Construction and the Package Carriers in Another Section of the Express Division of the Filene Store.

in general trucking and heavy transportation.

Each company of importance has affiliation with other companies for the transfer of packages and

goods, so that one making a collection in Dorchester, for instance, may deliver a package to another having service in Lynn or Salem, and the price paid is divided



Belt Conveyor Between the Two Series of Bins, Those at Right for the Store Service, and at Left for the Express Service, the "Charge" Packages Being Carried to the Belt Shown at the Background—In the Filene Store Shipping Room.

by the two according to the rate established in the contract between them. Contracts are the rule for such transfer service and rates are based on weight, although bulk may be a factor under some circumstances. But this transfer may be effective if the shipper wanted to send a package express to Keene, N. H., or to Newport, R. I., and if there should be need of making a second transfer this is provided for as above stated.

Wherever possible contracts are made to do work and these are for a price that may be considerably lower than that charged for transient service. In other words, a constant volume of business can be done for less price than an indefinite work. There is not only competition between the companies serving specific localities, but these companies are also competing with the Adams, National and American companies, all of which have many local offices. When it comes to general distribution the freight service of the railroads and the general express companies have the greatest number of representatives, but for some cities and towns the smaller companies can make better rates and give equally good if not superior results. This is true of shipments that are made to points several hundred miles distant.

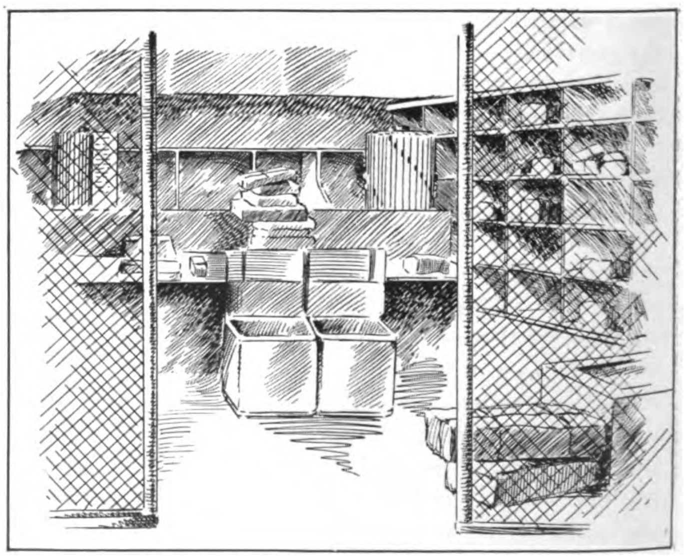
Motorized Equipment.

Aside from the American Express Company, which has 28 electric and six gasoline motor delivery wagons, and the National Express Company, which has 12 electrics, there is but comparatively little motorized equipment. There are 15 different concerns that have the name of "auto express" and the assumption is that a part of the haulage is done with machines, but just how many are in constant service is uncertain. Some use motor wagons in pickup and transfer work, collecting and distributing in the city and taking the freights to the outward destination, where they are delivered by animal wagons. One company, Chase's Express, located in Brookline, has adopted this system with excellent results. The fact remains, however, that but few motor wagons are used by the 343 express companies. There are seemingly large possibilities in this direction.

In several instances express companies have attempted to use motor wagons without success, and some of these concerns have resumed the use of horses. Whether or not this is the result of inexperience or endeavor to continue horse methods cannot be stated, but there is no possibility of avoiding the fact that much of the collecting and many of the deliveries are made in the badly congested streets, where the superior speed of the motor cannot be realized, and it is also a fact that the conditions for loading the vehicles could hardly be worse. In no instance is there provision made for quick handling of the loads and waits are very frequent. As an example of this the illustration of the Arch street office of the General Express Company will show that the wagons are ranged along the sidewalk and the packages are taken from the station and loaded. The drivers arrange their loads to facilitate delivery, but this is done with the wagons idle. There are certain formalities to be complied with so far as records are concerned, and this must be done by the driver. Not only this, if the motor wagon has a helper the time of two men is lost, as well as that of the machine, and no activity at the point of delivery will completely compensate for this. The manner of garaging and the driving are two unknown factors, and both of these are very important.

Parcel Delivery Companies.

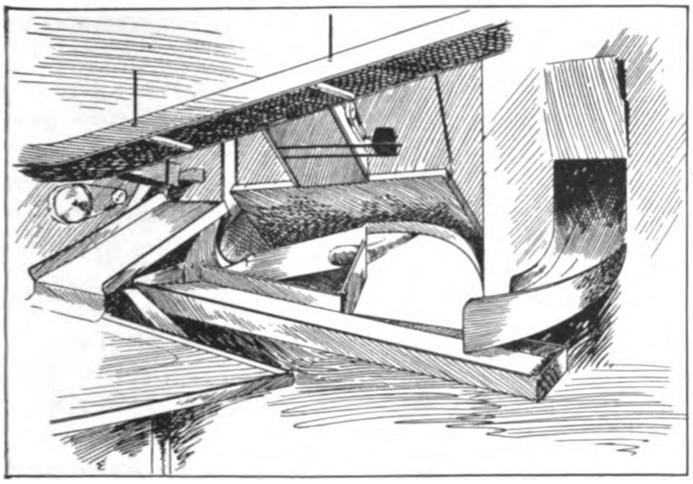
In addition to the express companies there are several parcel delivery companies that contract with the stores to make delivery. The oldest of these is the Boston Parcel Delivery Company, which was established in 1872 and has its central station in Stanhope street. The superintendent of the company is G. A. Pratt, who has had long experience with handling the



Charge Room of the Shipping Department of the Filene Store, Where the Packages Are Received, Examined, the Address and Account Verified and Records Made.

packages of many of the stores of Boston. The stable and the station are located in the same building and from 13 to 16 single-horse wagons are used daily. Ap-

proximately 1,000,000 packages are handled annually. The company makes delivery in what is known as the "city" and does not go outside of its recognized terri-



The Central Point of Collection in the Jordan, Marsh Company's Shipping Department, Whence the Packages Are Distributed to the Different Sorting Divisions.

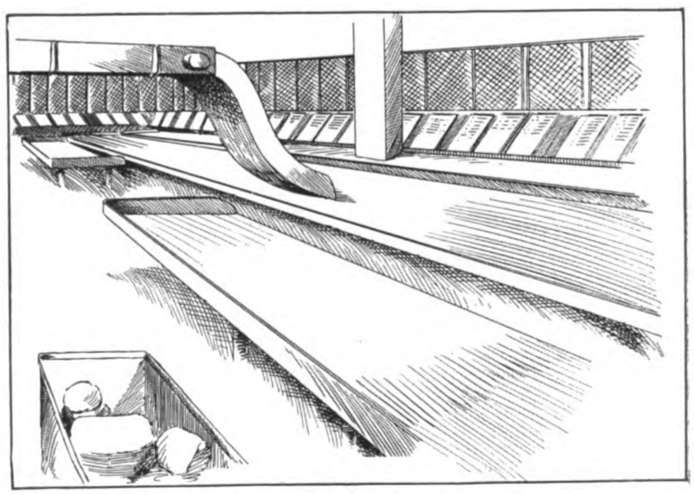
tory. It delivers the packages of the Filene and the Shepard, Norwell stores, and in addition serves a considerable number of other concerns. The method is to bring the packages from the stores to the station. They are then sorted for routes and are delivered from route wagons. Normally four deliveries are made daily. Collecting wagons make the rounds of the stores at stated intervals and collect the packages. The station is about a half-mile distant and the handling for the route wagons is accomplished very quickly. The packages that are to be sent to some of the express companies are sorted and these are later delivered to the receiving stations of the companies and are picked up. This is known as "transfer" work and from 15 to 20 per cent. of the packages handled are of this class.

Besides the regular places of call many special telephone calls are received from those doing comparatively small business, such as milliners, tailors and the like. Where the packages are numerous, contract is made for delivery and the price is five cents or six cents for a single package, according to the number handled, and the payment is made at regular intervals by the store. The tariff for a single package is 10 cents, but books of gummed stamps are sold to customers who do a small business, who can attach these to packages when delivered to the driver. This prepays the package. The price of the stamps by the book is $1.50 for 20. The sale of stamps minimizes the clerical work and this system is entirely satisfactory to the customer.

Packages will vary in size and weight and those weighing 15 pounds or less are given a "count" as a single, from 15 to 25 pounds two "counts," from 25 to 50 pounds three "counts" and more than 50 pounds four "counts," which means that the charge is twice, three or four times that of a single package. Boxes of considerable size, barrels, etc., are given four "counts." The great majority of the bundles are of the single "count" size, but large and heavy parcels are not desired because of the time required for handling them. The wagons are of the covered type with gratings at the sides and ends of the body to protect the goods from theft, with curtains that may be lowered in the event of storms. The crew of each is a driver and a boy, and much of the delivering is done by the boy. The routes are laid out with reference to the work that can be done in the periods that delivery can be made, the last being after the stores have closed for the day. The last wagon is into the station by 9 in the evening, and often before that time, although at some seasons of the year, as in holiday rushes, for instance, the time may be considerably later.

System of Delivery.

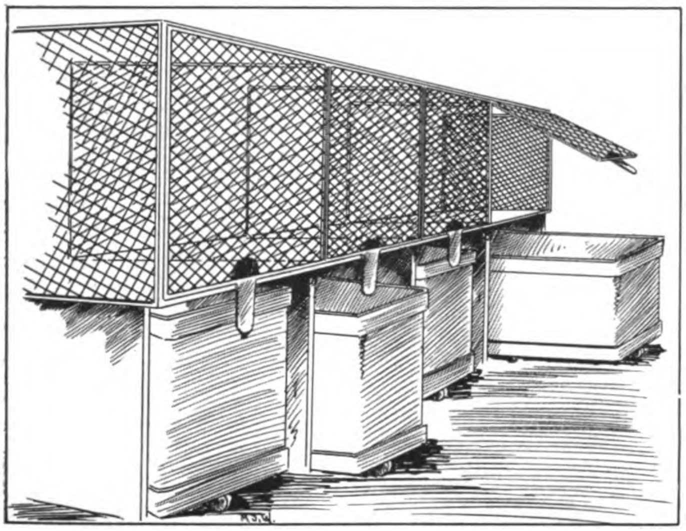
The people of Boston have been educated to receive their purchases the same day they are made, and while it would appear that many would be absent in the evening and there would be differing causes why many people could not be found, it is a fact based on long experience that comparatively few parcels are brought back into the station. The company makes transfers to other express companies and these, too, will make delivery in the same manner at a distance of 20 miles, though in such instances the packages are sent by passenger trains that leave Boston not later than 5 in the afternoon. The number of packages handled a day may be roughly stated to average with 15 wagons approximately 220, but there is considerable variance and it is probable with the reduction for transfer that the men will deliver from 150 to 250, these being the minimum and maximum figures. That the routes are comparatively short and the deliveries are close together will account for the high average, for in department store work the delivery of 100 packages is regarded as a good day's work. The drivers have to make collections on C. O. D. packages and each day settlement is made at the office and in turn adjustment is made with the houses sending out the packages, and returned packages are accounted for.



The Department of the Shipping Room Devoted to the Handling of the Bundles Delivered by the Jordan, Marsh Company's Delivery Equipment, Showing the "Tills" for the Packages and the Desks for Making Records.

The Boston Parcel Delivery Company has been largely responsiblefor creating the demand for quick delivery, for a score of years ago it was making no less

than eight trips daily from Winter street, using six wagons to a set. The hours of starting were 10, 12, 1, 2, 3, 4, 5 and 6. This was continued for a considerable



The Arrangement of the "Tills" and Carriers in the Department of the Shipping Room Where the Packages Delivered by the Jordan, Marsh Company's Equipment Are Collected.

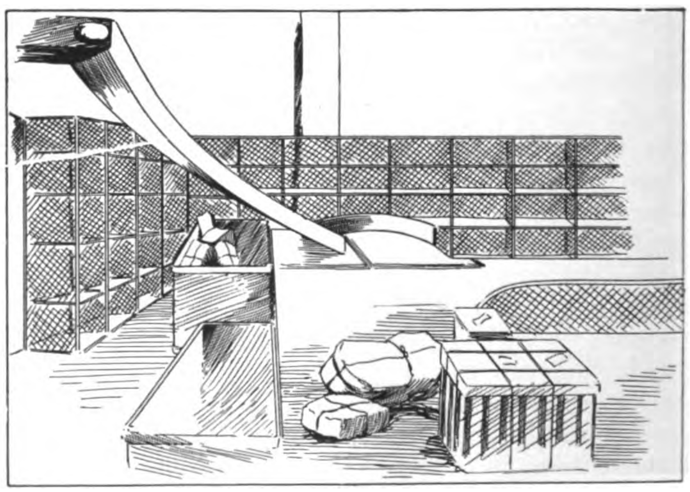
length of time, but the change was made to a fewer number of trips because on half of them not more than 50 per cent. of the vehicle capacity was carried, and, on the package basis, this meant a loss of money. Of these trips the first was practically devoted to exchange delivery and collection, the second was with a good load, that at 4 was with a big load, and the last was the largest of the day. The company afforded at that time the best service that was ever created for a city and was willing to even increase this, but it could not make unprofitable trips and so a change was made to the present basis of four trips a day and with distribution at its station, this saving the time of the wagons and the men to a considerable extent. With the expansion of the city and the increase of business into the suburbs the company continued to serve the original area, though the lines were extended to a small section of Brookline. But the character of delivery inaugurated by the company was demanded by the people living in the suburbs, and this, with the competition of the stores, brought about the distribution of goods practically the same day of purchase within a radius of approximately 20 miles, unless the conditions are unusual.

This company, however, does not give service to all of the stores. The Houghton & Dutton Company, Jordan, Marsh Company, R. H. White & Co. and the Henry Siegel Company each have service that includes the store equipment and the number of express companies that is necessary to reach the different localities. Besides the Boston Parcel Delivery Company there is the American Delivery Company, which similarly serves a number of stores and handles about 300,000 packages annually, besides doing more or less general transportation, and Craft's Parcel Delivery, which operates on a smaller scale, and many of the local express companies handle parcels delivered in that portion of Boston not reached by the regular "city" deliveries. These serve East Boston, Charlestown, Roxbury, Dorchester, Savin Hill, Jamaica Plain, Brighton, Forest Hills, Hyde Park, Roslindale, South Boston and other localities. Some of these companies do a very large business, but it is not confined to parcels.

System with Parcel Delivery.

The experience of those who have delivered parcels, especially in the sections where the routes are comparatively short and the customers close together, is that a great deal of the work is a matter of "legs," for this means that it is taking the packages from the wagons and to the houses. Where a package is delivered at the front door or any convenient entrance the time required is brief, but if it must be taken into a building and to an apartment, especially if it is a "collect" parcel, more time is needed. Often in the course of a day packages are left with other people than the customer, in the same building, in the next house, and sometimes after a search the package is brought back and is taken out on the next trip, or on a trip when the customer is expected to be at home. Many times the wagons call and take articles from homes to the store for changes, alterations, for cold storage, and for other reasons, and property so collected is at the expense of the store to which it is sent. Time is necessary for the work and if the work is not quickly done there is diminished profit.

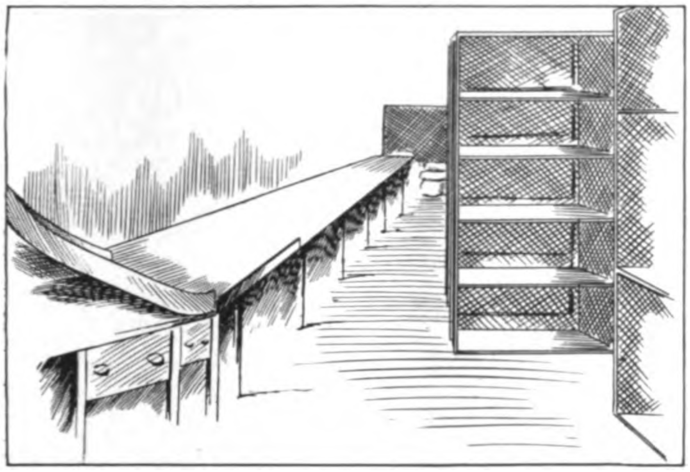
The minimum price of five cents for delivery within the "city proper" may appear to be a comparatively small charge, but it must be remembered that this merely calls for the haulage of packages from the stores to the station, the sorting for routes and distribution. The Boston Parcel Delivery Company has been a profitable concern. It has been well and economically managed and its overhead expense has been kept low. The company has the advantage of long experience and the prestige of a satisfactory service to its customers and the people. The company is willing to give what anybody is willing to pay for. The



Section of the Local Express Division, Where the Bundles to Be Distributed by the Express Companies Are Sorted and Placed in the Different "Tills" Assigned to Each Company.

driver of each wagon has the assistance of a good boy and the routes are so arranged that under ordinary circumstances each can be covered in approximately the

same time. The system of records is such that clerical work is minimized, and experience has developed that it is intensely practical. For smaller contracts



The "Transfer" Division of the Jordan, Marsh Company's Shipping Room, Where the Parcels Bought with "Transfer Books" Are Collected and Made Ready for the Delivery.

the price a package is larger, but the volume of business is more uncertain. The wages paid are moderate, but are sufficient to insure reliable help, and and the long experience of the company makes it possible to afford a protection to all its customers and the people. The length of the routes traversed will vary from five to seven miles, and a horse and a half is the allowance for each wagon. In the event of extra demands upon the service this can be provided temporarily by additional trips and the use of spare men. Normally the horses are not overworked, for good attention is as necessary as economy.

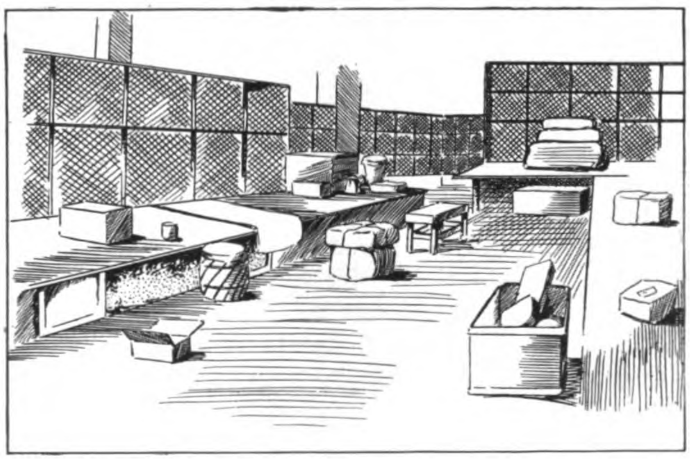
The American Delivery Company operates from 12 to 15 wagons, practically the same in construction and fitting as those of the Boston Parcel Delivery Company, and besides the delivery of store packages it distributes samples for numerous companies and will undertake any distributing work. The basis of payment for this service is approximately what has been stated, five and six cents a package within the "city" when contract is made, and where stamps are bought the price is $7.50 for 100. The price for a single minimum weight package is 10 cents, and the basis of counts is the same. Packages weighing in excess of 100 pounds are not accepted unless for the accommodation of a customer.

With the other companies the delivery rate is the same basis, but where a transfer is made to another company each receives the minimum rate. To illustrate, where a parcel is taken by one company and transferred to another the charge is double what would be charged for the handling by the one company. The package sent to Malden, for instance, will cost 10 cents, and the transfer is made by the collecting company to the station of the delivery company, where it is again collected and delivered. As a rule the companies have contract with each other, for there are formalities to be regarded with reference to collections, exchanges, losses, etc., which must be made through the collecting company, and there are responsibilities of this character that require a definite understanding. It is necessary for the stores, the customers and the express companies that these matters be given prompt attention.

Sorting of Packages.

Where the distance is greater the price is more, this depending naturally upon the number carried and the contract that can be made. Each large store makes contract with the express companies for delivery outside of the radius in which its own equipment affords service, but the policies of each differ. In some instances as many as 40 express companies make regular deliveries for a single store. The number of packages may vary materially, but in every case a contract is made for the work. Where contracts of this kind exist the wagons of the company call at the stores and take the packages. If the distance is short the haulage may be by wagon, by automobile, or the freight may be sent to one of the railroad terminals and shipped by express or passenger trains to the destination. Wherever received the packages are taken to a station, sorted and distributed, and considering the distances much of this work is quickly done. The custom with the suburban express companies is to sort the packages for routes and distribute them as do the parcel companies.

In New York and other cities the zone system or plan of distribution is often the vogue, this meaning the establishment of stations at different distances from the stores and conveying the packages and goods by wagon, automobile or train from the stores to those stations, where they are sorted for routes and distributed by wagons or motors owned or rented, or by men who have contract for this work when the volume of business does not justify store equipment. In one sense this is followed by the express companies centring in Boston. Some sort the packages on the sidewalks, as is the custom with all but one of the Boston stores, and leave with the goods ready for distribution. Others sort and arrange them at the stations. This work, however, cannot be done until the packages are

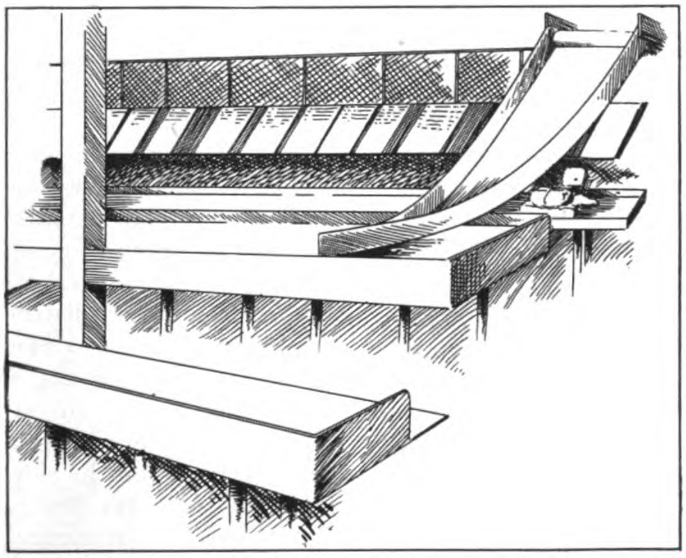


One of the Nine Packing Rooms of the Shipping Department of the Jordan, Marsh Company's Store, This Being Used for the Examination and Repacking of "Transfer" Sales.

ready for the wagons, and from 15 minutes to an hour is required, much depending upon the conditions in the shipping rooms and the celerity with which the goods

are sorted and packed for convenient handling.

The custom varies with the store, for no two have the same list of places for delivery. For instance, the Filene store has a list of 141 different localities in which delivery is made, and of these 18 are within the city of Boston, outside of the "city" proper. There are in Boston no less than 34 different sections or designations of locality. The White store lists 20 different sections of Boston, five of which are not listed by the Filene stores, and it does not list three that are on the Filene list. This comparison can be made with similar results with practically all the stores. The lists are posted for the information of the clerks so that the customers may be notified definitely when delivery can or should be made, and these usually state the times and if the store service or the expresses are used, Some stores group these localities under the name of the suburb, there being, for instance, two in Arlington, Chelsea and Saugus, three in Belmont, East Boston and Watertown, four in Everett, five in Revere and Dedham, six in Medford, Brighton, Milton and



Portion of the Division Where the Packages to Be Delivered by Parcel Post and Express Companies Are Received and Sorted, in the Jordan, Marsh Store.

Quincy, seven in Somerville and eight in Malden, Brookline and Newton. Because of this difference in policy it is not practical to determine the exact scope of service from these lists.

Several endeavors have been made to bring about co-operation of the large stores of the city in making delivery, and it was the support given this proposition that resulted in the organization of the Boston Parcel Delivery Company. Prior to 1898 all of the delivery was made by horse wagons, and in that year the Houghton & Dutton Company bought two Electric Vehicle Company's delivery wagons and used them for several years with more or less success. The machines were crude as compared with those placed in service in 1900 by the New England Electric Vehicle Company for public service in Boston. They were used in local delivery on different routes and, considering the inexperience with electric vehicles, the construction, the facilities for charging and the attention given them, did excellent work.

Pneumatic Tube Service.

The American Pneumatic Service Company established itself in Boston in 1901, this being a plant similar to that built in New York, Philadelphia and other cities. The central station was located at Essex street and Harrison avenue, where the branch postoffice station now is, and wooden tubes were laid in the street to stations at the South End, Roxbury and to Huntington avenue in the Back Bay, and by compressed air force packages were sent from the central station to the suburban stations, where they were sorted and distributed on routes by 20 wagons. It was necessary to deliver the packages at the central station from the stores and the collections were made frequently and the tubes were used constantly to supply the different sub-stations. The company did the delivering for the Shepard, Norwell Company and a number of smaller stores. In 1904 the United States government hired the Essex street station for a branch postoffice and used the tubes to send mail to branch postoffices which supplanted the delivery stations. The wooden tubes were replaced by metal and these exist and are used today by the postoffice. The company established a station in West Newton street and there continued to make delivery until 1909, when the business was discontinued. The company derives a substantial revenue from the use of its plant and exists today, for the government has similarly taken over its service in the other cities. The service was quick and satisfactory, but the size of the packages was limited to perhaps eight inches square and in weight to perhaps 20 pounds. Those of greater bulk or weight were necessarily delivered by other means.

Early Motor Equipment.

The Boston Auto Express Company was the first public service corporation to make use of motorized equipment. The company was organized in December, 1900, the head of it being Hugh Brown, president of the Hotel & Railroad News Company. The company purchased six Vehicle Equipment electric 3000-pound delivery wagons, which were delivered about August, 1901, and it contracted for 16 Knox single-cylinder delivery wagons. The company established stations in Chelsea, Brighton, Dorchester, Somerville and in Boston, and the parcels were collected in the city and delivered to these stations by the electric wagons, and then were distributed on routes. In Boston the company served the Houghton & Dutton store and a number of small houses, and also handled the out-of-town packages for the White, Stearns and Jordan, Marsh stores out of the city and in the sections covered by the company. The organization was thorough and the service given was excellent considering the equipment and its crudity, and the company would have undoubtedly continued, but Mr. Brown's health precluded his giving the attention necessary, and finally the business was discontinued in December, 1903, the electric wagons being sent to the St. Louis Exposition for service there, and the 16 Knox wagons were acquired by the Houghton & Dutton Company. These wagons were used with gradually

decreased numbers until 1906 and then the company turned to horses again for the principal part of its delivery.

E. P. Morse was treasurer of the Boston Auto Express Company and when the company wound up its affairs he became associated with the Houghton & Dutton Company as manager of the transportation department, and he continues to supervise the delivery of the company as assistant general manager. Capt. Harry F. Dutton and Mr. Morse have long been convinced of the utility of the motor wagon. The Knox wagons were useful, but were found to be not sturdy enough for the work, and they were in some instances rebuilt. The divided rear axles were replaced by solid constructions, jackshafts and double chain drive were substituted for the single chain, heavier springs were installed and 42-inch wheels were placed on the rear axles. These changes were not made with all. for as the machines become unserviceable they were disposed of, but the company now has two of these rebuilt wagons which are now known as Houghton & Dutton specials. The company purchased two 2000-pound General Vehicle wagons in 1909, another of the same make and size in 1910, a 1000-pound Lansden wagon and two Packard three-ton trucks in 1912. so that with the two rebuilt wagons it has eight motor vehicles in all in its service. Its horse equipment consists of 125 animals and 60 single and double wagons, teams of two horses being used for freight and furniture haulage.

Houghton & Dutton System.

In 1904 the company erected a building at Beacon and Ashburton streets and on the second floor of this fireproof structure made a combination shipping room, loading room and small electric garage. This department is reached by a long runway from Ashburton street. Three sides of this large room are devoted to the shipping and on the fourth side is the electric garage and the stock room in which the supplies and parts of the machines are kept. Three machines can be placed in this garage and there is a small charging panel at which three batteries may be charged. The centre of the department will accommodate a dozen horse wagons of about 20 motor vehicles. The centre is the loading space and about it on three sides are the 38 compartments into which the goods to be shipped are placed when sorted for the routes. These compartments are about four feet wide and eight feet length and have doors the full width from the shipping room and the loading space. They are the full height of the story.

There are three packing rooms in the building, and from these the packages are brought on trucks or carriers and by elevators to the shipping room floor. Spiral chutes will be used as soon as the reconstruction of the original building, now in progress, is completed, and the use of the elevators is merely temporary. Reaching the shipping room they are placed on inclined receiving runs, this to prevent accumulation and the consequent delay of the bottom packages. One run is for the small parcels and the other for the large. At the runs the packages are sorted and carried by fl trucks to the different bins or compartments, wh they are ready for the drivers. The records are ceedingly simple and are made out from the sales sl on billing machines in duplicate and each driver si for the packages he receives. The original sheet t he receives must be returned with a record of the position of the packages and aside from a check m for each parcel and his signature he has no entries make.

The wagons or machines are driven into the bu

STATIONS.		Rate per 100 lbs.	MINIMUM CHARGES			
			1 to 10 lbs.	10 to 25 lbs.	25 to 50 lbs.	50 to 100 lbs
Abington	Mass.	35	15	20	25	35
Atlantic	"	15	15	15	15	15
Avon	"	25	15	15	20	25
Braintree	"	20	15	15	15	20
Bridgewater	"	35	15	20	25	35
Brockton	"	25	15	15	20	25
Bryantville	"	45	15	25	35	45
Chestnut Hill	"	30	15	15	25	30
Eastondale	"	35	15	20	25	35
East Bridgewater	"	35	15	20	25	35
Fall River	"	40	15	20	30	40
Fayville	"	30	15	20	25	30
Framingham Center	"	30	15	15	25	30
Framingham Junction	"	30	15	15	25	30
Freetown	"	40	15	20	30	40
Hanson	"	45	15	25	35	45
Holbrook	"	25	15	15	20	25
Hudson	"	30	15	20	25	30
Hough's Neck	"	20	15	15	15	20
Island Park	R.I.	60	30	35	45	60
Kingston	Mass.	45	15	25	35	45
Lakeville	"	40	15	20	30	40
Marlboro	"	30	15	20	25	30
Middleboro	"	40	15	20	30	40
Middletown	R.I.	60	30	35	45	60
Natick	Mass.	30	15	15	25	30
Neponset	"	15	15	15	15	15
New Bedford	"	40	15	20	30	40
Newport	R.I.	60	30	35	45	60
Newton Centre	Mass.	30	15	15	25	30
Newton Highlands	"	30	15	15	25	30
Newton Lower Falls	"	30	15	15	25	30
Newton Upper Falls	"	30	15	15	25	30
Norfolk Downs	"	20	15	15	15	20
North Abington	"	35	15	20	25	35
Northboro	"	30	15	20	25	30
North Dighton	"	40	15	20	30	40
North Hanson	"	45	15	25	35	45
North Middleboro	"	40	15	20	30	40
North Natick	"	30	15	15	25	30
North Raynham	"	35	15	20	25	35
North Tiverton	R.I.	60	30	35	45	60
Plymouth	Mass.	45	15	25	35	45
Portsmouth	R.I.	60	30	35	45	60
Providence	"	60	25	30	40	60
Quincy	Mass.	20	15	15	15	20
Randolph	"	25	15	15	20	25
Raynham Centre	"	35	15	20	25	35
Rehoboth	"	40	15	20	30	40
Rockland	"	35	15	20	25	35
Saxonville	"	30	15	15	25	30
Scotland	"	35	15	20	25	35
Seaside	"	45	15	25	35	45
Seekonk	"	40	15	20	30	40
Shrewsbury	"	30	15	20	25	30
Somerset	"	40	15	20	30	40
Southboro	"	30	15	20	25	30
South Braintree	"	20	15	15	15	20
South Dighton	"	40	15	20	30	40
South Easton	"	35	15	20	25	35
South Framingham	"	30	15	15	25	30
South Hanson	"	45	15	25	35	45
South Portsmouth	R.I.	60	30	35	45	60
Taunton	Mass.	35	15	20	25	35
Tiverton	R.I.	60	30	35	45	60
Waban	Mass.	30	15	15	25	30
Weir Village	"	40	15	20	30	40
Wellesley Hills	"	30	15	15	25	30
Wellesley Centre	"	30	15	15	25	30
Westboro	"	30	15	20	25	30
West Bridgewater	"	35	15	20	25	35
West Dighton	"	40	15	20	30	40
Whites Corner	"	30	15	20	25	30
Whitman	"	35	15	20	25	35
Whittenton	"	40	15	20	30	40
Wollaston	"	20	15	15	15	20
Worcester	"	35	20	25	30	35

Some of the Rates Charged for the "A" Service of the Ele Express, Which Means the Collection and Delivery of Packages by the Company's Wagons.

ing and backed to the nearest place to the comp ment that contains the packages for the route. loading is very quickly accomplished and there is confusion, no interruption by traffic, and it is alw sheltered from the weather. The department is ur the direct supervision of the shipper and he is alw accessible. In this department is also the office, wl the settlement of collections are made, and each

counting is made before another load is taken out. By relaying the wagons into the shipping department it is practical to load many times the number of packages taken out, and the loading space can be utilized as an electric garage without in any way interfering with the convenience of the arrangement. This shipping department was planned in 1904 when the building was erected, and it was ready for occupancy the following year. It is the only one of the kind in Boston, and is equalled only by one or two stores in New York. It might be said that this provision was made by the firm because of the conviction of Capt. Dutton and Mr. Morse that the motor vehicle would be the equipment that they would eventually use for delivery and the desire to have facilities that would yield the most satisfactory and economical results.

The electric vehicles are garaged in the shipping department and the gasoline wagons and trucks are garaged at Hancock square in Charlestown. The mileage of the electric machines is from 40 to 45 daily, and the gasoline vehicles considerably exceed this, for two of them are used for furniture delivery and the like. Much of the freight haulage is done with the horses. The store delivers in the "city" with the starts from the shipping department at 10, 2, and 5:30 daily, and the deliveries by the store equipment in Allston, Arlington, Belmont, Brighton, Brookline, Cambridge, Charlestown, Chelsea, Dorchester, East Boston, Everett, Forest Hills, Jamaica Plain, Malden, Medford, Melrose, Mount Auburn, Newton, Orient Heights, Revere, Roxbury, Somerville, South Boston, Waltham, Watertown, Waverley and Winthrop, and by expresses in Atlantic, Dedham, Greenwood, Hyde Park, Lexington, Mattapan, Milton, Neponset, Quincy, Roslindale, Stoneham, Wakefield, West Roxbury, Winchester and Woburn. These deliveries are made once or twice daily, from 10 in the morning until 5 in the afternoon. Nineteen of these places have one delivery and the remainder two. Those in Dorchester, Medford and Newton are made by the electric machines. Besides this there are special trips to make emergency deliveries. In addition there is the distribution by the express companies covering points more distant, as well as by the parcel post service and the Electric Express. In some instances the express packages are sent to the receiving stations by wagons and in others they are called for, but the local express companies always call. The parcel post packages are sent to the postoffice at frequent intervals. The company delivers orders to the value of $1 free in Massachusetts, except house furnishings, groceries and patent medicines, but all goods to the value of $5 are delivered free in New England, except sugar, flour and patent medicines. This delivery means to the nearest express, freight or postoffice, and no C. O. D. less than 98 cents is sent by express. All shipments are made from the store save furniture, which is supplied from a warehouse at Charlestown and is sold from samples.

Filene Shipping Department.

The shipping room of the Filene store is in the second sub-basement and it occupies the greater part of this section of the building. This store does not handle furniture, groceries or meats, and deals principally in articles of wearing apparel for men and women. The packages are collected on each floor and sent by a spiral chute to the shipping room, where they are received on a conveyor belt. The conveyor system consists of a long belt that extends through the centre of the room. Looking in the direction in which the belt travels at the right is a high bench under which are carriers. Beyond this is a series of bins or compartments beneath a top inclined at either side at an angle of 45 degrees, this top serving as a desk on which the drivers' record sheets are made out. Beyond this is another high bench and a long row of carriers. At the left is the office of the shipper and his assistants and the charge room. In the charge room all the charge packages are examined and the records made. At the end of the long belt there is another at right angles that receives the packages and carries them between two lines of bins, the one at the right for the store delivery, and the one at the left for the local express companies. The packages are taken from the conveyor and placed in the bins. After the records have been made they are placed in the carriers ready for the drivers. Again the conveyor turns at right angles and a short belt takes the charge packages to the charge room, and after the entries have been made they are placed on another belt that continues in the same direction. In a packing room the fourth angle is made and the belt takes the charge packages and those from the packing room back to the original place of starting, where they are dropped onto the main belt and carried around to the places where they are removed and placed in the proper bins.

The delivery of this store in the "city" is by the Boston Parcel Delivery Company, in a number of the suburbs and in Boston itself the company uses a fleet of 19 Ford delivery wagons, and outside of this area there is the contract service with express companies, the regular service of the New England and general express companies, the Electric Express and the parcel post. This means that the packages must be divided into groups in the shipping room, but there are no separate rooms for divisions. The packages are placed in the wheeled carriers after the entries have been made on the record sheets, and at different times the carriers are taken by the drivers, placed on elevators and carried to the sidewalk, where the bundles are sorted for the company's equipment and for some of the express companies making direct delivery. The facilities for shipping in this store have been well worked out and have been designed to do a very large volume of work with minimum handling. The means are extremely simplified, the belt conveyor encircling a rectangular space, with the bins and carrier spaces arranged so as to provide for any reasonable expansion through special or general sales. The carriers are located convenient to each series of bins and when these are filled additional carriers are available. The city delivery leaves the store at 10:30, 2, 4 and 6 each day, and the deliveries by the store equipment are at

1 and 6 each afternoon. The deliveries by the contract expresses are either once or twice daily, the time varying to meet the schedule of the express companies. The parcel post packages are taken to the postoffice whenever the quantity justifies, a load for a vehicle usually being taken. The shipping room list calls for 141 places of delivery outside of the "city," and of these 39 are served by the company's machines. The work done by the light delivery wagons is large in mileage, as much as 115 miles having been made in a day with two trips over a route, and the carrying capacity of the machines is comparatively small. The wagons are manned by a driver and helper and usually the delivery is made by the helper, the driver giving attention to the machine and the load, he having the responsibility.

Loading at a stated hour means that from 12:15 to 1 or later, and from 5:15 to 6 or later some or all of the machines are lined along the store in Hawley street. The drivers go to the basement, bring the carriers containing the packages up on the elevators (the illustration will show there are two of these), and the carriers are either left in the entrance and the bundles are carried to the wagons, or the carriers are taken to the wagons on the sidewalk. Sorting is accomplished under difficulties as during the time the wagons are loading the walks are usually thronged with people, for the first loading is during the lunch hour and the second when the people are leaving their places of business. Hawley street is narrow and there is a car track through it, so that it is necessary for the greater part of the packages to be carried along the sidewalk and packed in the order in which they are to be delivered. While the time required for this work may vary, not infrequently the wagons are from a half hour to an hour in the street. A permanent canopy overhangs the sidewalk the full length of the side of the building, but this does not cover the machines or wagons in the event of storm. Besides the store equipment the express wagons must be similarly loaded and though not as much time is required the space in the street is occupied. The demand of the people that the deliveries be made cannot be denied. The service must be made alike, and late in the afternoon the street beside the store has a long line of waiting machines and wagons. The shipping room handles the delivery quickly, but the necessity of having the machines and the wagons leave at specified times entails waits, and the elevators are decidedly limited in capacity.

The company began its own automobile service in July, 1912, with 19 machines, and these were garaged at Montgomery and Tremont streets until recently, when they were sent to a garage in Aberdeen street, in the Back Bay. The drivers are paid $16 weekly and the helpers are paid $9 each. The new building was occupied in September, 1912, and this structure was planned for meeting every requirement of the business. There is, however, practically no provision for loading the machines and wagons off the street, and it is impossible to change the conditions unless there is eventually a means found for making a loading room on the street level through which the wagons may be driven. The only manner in which this could be done would be by taking a section of the ground floor extending through the store, and this would mean the loss of much valuable space now devoted to sales departments. The delivery of the store will approximate close to 1,000,000 packages annually, and the cost will vary with the character of service and the localities served. It is necessary that extreme care be taken in handling the goods and the packages are more than ordinarily carefully packed, all of which adds to the expense. The average cost of delivery will approximate 12 cents each. The parcel post service has been found serviceable, but not always satisfactory, because of the condition of the packages when received by the purchaser.

Jordan, Marsh Company.

The delivery of the Jordan, Marsh Company is one of the best organized in the world, and it is only equalled by three stores, two in New York and one in Chicago. The store has nine packing rooms in the old building and the annex, and the collection of packages is made on each floor every 15 minutes or less. The old building has four stores and the annex nine. Spiral chutes carry the packages to the basements and in the old building there is a station where the charge bundles are sorted out, the addresses and the responsibility of the customers verified by means of card indexes. The bundles are then placed on a belt conveyor and taken to the shipping room in the basement of the annex. The charge bundles from the annex are similarly verified and checked. The bundles from the annex come down a spiral chute and are brought from the old building to a central distributing station, where they are sent by belt conveyors to the different divisions. One very large room is devoted to receiving the packages that are delivered by the company's own service, a second is used to collect the local express packages, a third for the general express and parcel post packages, a fourth for the collection of the purchases by "transfer," a fifth to the packing of the "transfer" sales, a sixth to the examination of goods that are returned for refund or exchange, a seventh for packing, and there are others for the clerical forces and for incidental work. The shipping department requires the whole of the sub-basement and its equipment, which is not ornamental in any sense, but is built for service and endurance, represents an investment of not far from $75,000. As may be assumed this was planned with great care and with a view of making provision for every need that might arise. Nothing that could be desired is lacking and it is practical to add to the equipment to even increase its usefulness.

The store delivers between 3,500,000 and 4,000,000 packages a year, and the average cost of delivery is seven cents a package, which is less than the expense a package of the other Boston stores, because of the greater volume and the fact that the wagons as a rule carry more a route. This price is applied to every

(Continued on Page 543.)

The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

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WIDE TIRES AND GOOD ROADS.

The wear of the steel tire upon a hard road surface is certain, and it must be evident that this wear is proportionate to the tire width. The more consolidated the roadway the greater the effect of traffic, for there is no resiliency to either surface or wheel. Obviously the only remedy is the widening of the tires to have such area that the pressure under load will be within what may be determined as the safe weight, though this is a factor that has never been satisfactorily established. Laws requiring wide tires exist in many states, but they have seldom been enforced. The reason primarily is that the wagon manufacturers have built wheels that, while they may have been sufficient in strength, have had narrow felloes and tires because this construction is cheaper from a manufacturing point of view, and competition has seemingly justified this assumed economy, especially as the purchasers paid less for the vehicles. There is no question that animals cannot haul as much with narrow tires as with wide and that there is a material loss in haulage with such equipment. This being so, the saving in initial price is trifling compared with the actual expense in continued use of wagons as generally built, to say nothing of the excessive wear of the roads.

This can be applied to all highways except such as are paved. The wide tire of the motor vehicle, with a comparatively light surface pressure, is not the same factor for wear that is the steel tire with a very heavy surface area. Rubber motor wagon shoes are by no means as wide as they ought to be, considering the loads carried, but this is not meant to imply that the wear upon the road surfacing is proportionate to the wear on the tires. The real factor is the weight a square inch of tire area. The steel tire and its heavy surface pressure cause internal movement of the road structure, and the wear of the rubber tire is confined to the surface of the highway. In any event the wider the distribution of the influence of the tire upon the roadway the better will both endure. The use of tires that are sufficient in size to insure long service and minimize road wear is, apparently, the best protection that can be given both vehicle and highway until the ways have been constructed to endure every form of traffic.

WHO DIRECTS DELIVERY?

Before attention was so generally directed to the economies possible or practical in haulage, it is probable that more than 95 per cent. of the highway transportation of the nation was left to the discretion of the driver. In fact, this condition very largely obtains today. This applies to loading, hauling and unloading. Where the owner supervised the work the efficiency was not necessarily high. Custom, the example of others, was regarded as a sufficient guide. In every instance, however, where economy has been the main object sought, this has been accomplished only by the greatest care and attention to detail. System and supervision is absolutely necessary.

While it is true that exceedingly capable men may have begun at the bottom of transportation work, it is also a fact that capacity has been generally recognized. If the driver is permitted to exercise his judgment with reference to delivery service it is reasonable to assume that the standard of efficiency will be practically what he cares to make it. In large transportation work every detail is planned with extreme care, and the efficiency is relatively high and the economy is at parity with the supervision. The man who can give the same attention to his haulage that he does to any other detail of his business can obtain results, and it might be well to emphasize that it is only through accurate knowledge, not estimate or supposition, that economies can be brought about.

To determine economy or waste it is necessary to establish a definite basis from which comparison can be made. Because of the variables what will serve in one locality or business cannot be applied generally. Averages are not sufficient. The only logical foundation is that obtained by carefully kept record, and in the absence of this information it is desirable to have such accounting system as will afford the detail, and continue whatever may be necessary to demonstrate loss or gain. The supposition that the detailed statement of another business is adequate is nonsensical, because of the difference in the factors, which could not under any circumstances be at parity.

SMALL BREWERY MOTOR DELIVERY.

Service of Beadleston & Woerz in Lower New York City, the Development of Eleven Years' Experience with Machines, Admirably Maintained and Affording Large Economy.

THOSE who have to do with delivery in New York realize that the conditions in the lower section of the city are exceedingly complex because of the generally narrow streets and the great volume of traffic passing through all thoroughfares in both directions. The streets extending north are intersected by those from east to west at distances that average 20 to the mile, this giving the block a width of less than 250 feet from north to south and length from east to west of from 500 to 1000 feet. Because of the comparatively small number of highways at the south end of Manhattan running north the traffic is necessarily very heavy in them, and as these must be crossed by the traffic from east to west and vice versa the interruptions are very frequent. From 6 in the morning until 6 in the evening the highways are crowded, and during the remainder of each day they are well nigh deserted.

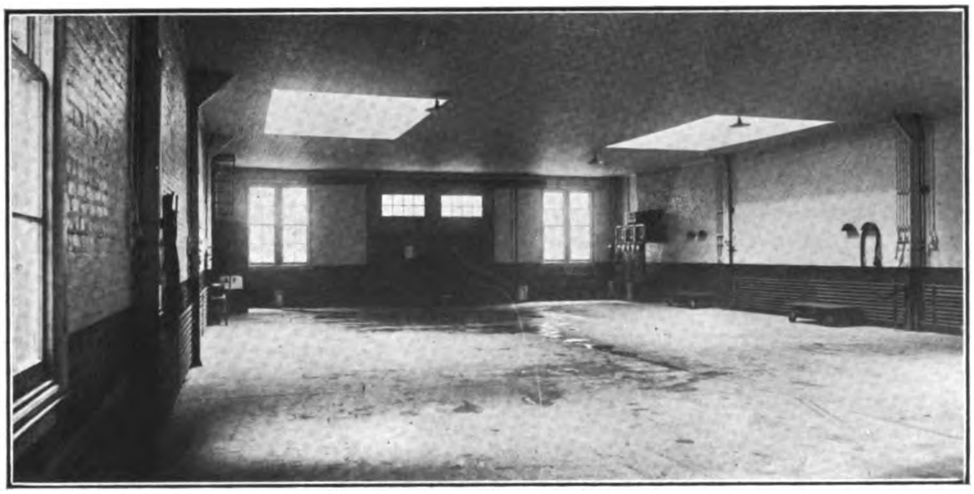
Because of the lower part of the city being largely given over to business, the high rentals limiting the areas of shops, stores and warehouses, the large number of transactions, receiving and delivering, is practically a daily necessity, and, as may be assumed, there is more or less delay in loading or unloading vehicles because of the absence of adequate facilities, or, to put it another way, the impossibility of places of business making provision for handling stock of any kind in the least time and at a minimum of expense. Add to this the loss of time through the congestion of traffic and it will be apparent why it costs more for transportation in New York City than in any other place in America where the streets are paved and improved.

This comment is made from the fact that any concern doing business in what is regarded as lower New York pays a greater price for delivery and haulage generally than in other parts of the city where the conditions are more favorable. There is no probability that there will be material improvement in the thoroughfares, and with the increase of business the only apparent relief that can be brought about is through street economy—the substitution of vehicles requiring less space, and this means the eventual use of the motor wagon or truck. As will be evident it is necessary for the conveyances to move constantly through the traffic, and as night haulage has not been considered nor business conditions adapted to more evenly distribute the volume throughout the day, the concern doing business in the extreme southern end is generally compelled to maintain a larger equipment than might be necessary were there less traffic congestion.

The brewery of Beadleston & Woerz, which was established many years ago, is at 291 West 10th street, and the property extends through the width of the block to West 11th street. Though small as compared with some of the mammoth breweries of the metropolis, it does a very substantial business, and its distribution is over the city proper, but does not extend in large volume into the suburbs and surrounding cities. Like all breweries conducted by men who were trained to the economies of Europe, and which are yet noticeable in plants in which these methods have been continued because of such training, the delivery department includes a blacksmith shop, wheelwright shop, paint shop and harness shop, all of which have been used for years. The delivery equipment consists of 10 five-ton and two three-ton electric trucks, and five gasoline trucks, a three-ton Packard, a five-ton Hewitt, two five-ton Macks and one six-ton Saurer, about 35 horses and a number of horse trucks and wagons.

The Fleet of Trucks in the Delivery Service of Beadleston & Woerz, Brewer, at 291 West 10th Street, New York City.

The delivery of this brewery is scattered well about the city, but there are localities where the customers are more numerous than others. A considerable part of the deliveries are made within what may be regarded as the section where the traffic is most congested during the day, and the others are where there is more freedom of movement. The company, however, does not do much business that might be termed casual or transient, because such patronage has not been found as profitable as the constant custom, and there is not much need of special service to meet the occasional



The Interior of the Garage for the Electric Trucks of Beadleston & Woerz, West 11th Street, New York City, Converted from a Stable.

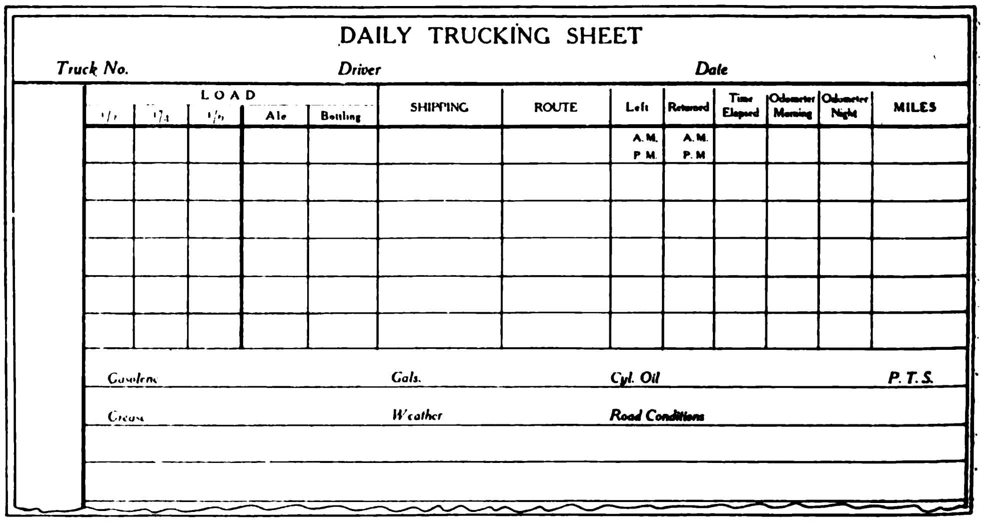
demands of parks, places of amusement, etc., during the summer months. In other words, the business has been developed without regard to uncertain patronage and careful attention has been directed toward serving regular customers.

The first truck bought was built by the Electric Vehicle Company, of five tons capacity, which is numbered 98, and it was delivered May 15, 1902. This machine was worked carefully and, considering the capacity of the battery, it gave excellent results. This was followed by a second and then a third machine of the same make. The experience was varied and under all sorts of conditions. Despite the comparative crudity of the trucks as contrasted with those of today and the limitations by mechanical construction and the batteries the work was found to be more economical than with horses, to say nothing of the greater elasticity and the reserve when the volume of business increased, for the deliveries may be 300 per cent. more in the extreme hot weather than in midwinter. The first trucks were garaged at the stable of the company, and after the utility of the machines was well established, this extending over a period of about four years, the conclusion was reached that as the business increased and additional vehicles were required the animal equipment would not be added to.

The first gasoline truck was bought about six years ago, and then a small brick garage was built, this having capacity for 10 machines by crowding. In this garage a charging panel was installed that will charge five batteries simultaneously and the machines were divorced from the stable. The motor equipment was placed in charge of the head of the delivery department, Ernst Reinhardt, who had supervised the deliveries for 20 years, and he was expected to obtain results. When the first truck was purchased a capable machinist, who was familiar with electricity, was instructed to give it whatever care was necessary. With realization of the need of systematic attention he was held responsible for the condition of the machine. It was bought for business purposes and it was necessary that it be operative, but deterioration was not to be permitted.

The mechanic caring for the truck was intelligent and he studied it. He made a careful study of the battery. He was encouraged to attain proficiency, and he did so with a commendable thoroughness. He acquired sufficient skill to rebuild the batteries and to develop their capacities to the limits. When the gasoline truck was bought it was turned over to him with the expectation that it would be similarly kept. But this machine was bought without a body and Mr. Reinhardt had his own shop produce an equipment that to his mind was exactly suited to his purposes. Mr. Reinhardt transferred drivers from the horse wagons to the electrics, and he found them in every way satisfactory. Then he educated others until there was not a man driving who could not drive horses and trucks. He had his own ideas of competency and men who could prove themselves efficient by his tests were hired. When the gasoline truck was placed in service he similarly educated his men to the use of it. With this system he was never without satisfactory drivers should any of those driving the trucks be incapacitated.

The business of the company increased and as it did so additional electrics and gasoline trucks were bought, there now being in the service the three Electric Vehicle machines and nine General Vehicle trucks. No more horses were bought to meet the in-



DAILY TRUCKING SHEET

Truck No. Driver Date

LOAD [illegible]	[illegible]	[illegible]	Ale	Bottling	SHIPPING	ROUTE	Left	Returned	Time Elapsed	Odometer Morning	Odometer Night	MILES
							A.M. P.M.	A.M. P.M.				

Gasoline Gals. Cyl. Oil P.T.S.

Grease Weather Road Conditions

The "Daily Trucking Report," Printed in Black on Heavy Manila Paper, Six Inches Length and 9.25 Inches Width, Perforated for Loose Leaf Binding.

Date	Left	Home	1-2	1-4	Route	Miles

Book Record of Daily Work and Mileage of Each Truck, the Data for Each Year Being Shown, Being Entered from the "Daily Trucking Report."

crease of business, but the stable was kept up to the number of animals that had been in service because these had a use that was regarded as economical. But so satisfied is the company of the efficiency of the motor trucks that it is not intended to buy horses and as the animals now used become worthless for the work they will be disposed of. It is expected to add two trucks a year, each taking the place of six horses, until the equipment is motorized.

A horse stable in West 11th street has been converted into a garage. This is a single-story brick structure that is 102 feet length and 48 feet width, with several large skylights besides the end windows and a wide door, that is practically free from posts. No equipment has been installed that will take from the floor space and it is believed that this will be sufficient to meet the requirements of the company for a considerable length of time. All of the electric trucks are kept here and the old garage is given over to the gasoline machines. The charging panel will charge 16 batteries at the same time, and it is apparent that this would serve for at least double the number of trucks now in use. A section of this building is used as a battery room, where whatever work is necessary is performed.

The old garage is used entirely for the gasoline trucks and as a repair shop, it having such facilities as are needed, much of the work being done at the blacksmith or machine shops, and all the bodies are built in the wheelwright shop, while the painting is done by the company's men. The garage is in charge of the engineer, as the head mechanic is known, who has a machinist assisting him, and these two men care for all the trucks, but the charging is done at night by a man who is experienced with batteries. The rebuilding and overhauling of the batteries, however, is done by the engineer, or under his supervision. The engineer has regular hours, but when necessary he gives whatever time may be required nights.

As to the maintenance of the electric machines the three old trucks are in service and are doing excellent work, while the six-year-old gasoline machine is running admirably, having recently received an overhaul. The work is hard and the trucks are not spared, but they are well kept up and they are carefully driven. These vehicles are economical —just how profitable as compared with horses is not stated —but this fact is evidenced by the statement that the company will buy no more animals, and when much of the work is done where the horse is assumed to have the greatest value in haulage.

The trucks are worked according to the routes, some covering greater mileage than others, and under ordinary conditions most of them make two trips, returning to the brewery for the second load from 11 until 1. The average load of a five-ton truck is from 50 to 56 half-barrels, but more than 50 is seldom carried. Each driver supplies his customers and he is expected to keep the ice boxes filled so that in the event of extreme heat where the consumption is large, or in severe winter weather when a trip might be omitted, there will be a sufficient supply on hand. By this system a day or even two of bad weather, such as snow to a considerable depth, does not inconvenience the customers, and in periods of intense heat an extra trip will amply provide for all requirements.

The success of this policy is in first filling the ice boxes of all the customers and then making the deliveries regularly, each always having such reserve that there will be no shortage in event of excessive demands. Should it be necessary it is possible to "boost" a battery, or even to replace it with another, but usually the battery capacities are kept high. The mileage of a truck will range from 20 to 35, but the average will exceed 25 daily. The crew of a gasoline truck is two men, while one man handles an electric machine.

The shipping department and loading platform are at the 11th street end of the plant, and in the office of the shipper is a blackboard on which is placed each afternoon the orders to be delivered the following morning, and when the men return at noon their orders are posted before the afternoon trip, this record being necessary in the event of a change of drivers. The blackboard merely gives the total of each size of container to be taken out, and the distribution is made from

Bought____________ Factory No.____________

License No.____________

ELECTRIC OR GAS

Year and Date	Make	Meter	Meter	Remarks

The Record of Tire Use, Entered in a Book of Convenient Size, Each Make of Tire Separate and Shown by the Maker's Serial Number.

these, no order of specific containers being filled as a rule.

Besides the delivery much of the haulage of supplies, etc., for the brewery is made by the department, this being from various terminals and piers and from warehouses, and while for this work horses are generally used, the trucks are frequently utilized. This haulage is after the deliveries of the day have been made if the trucks are employed.

The drivers are expected to report the condition of their machines if there is need of attention aside from that given systematically, and such report is taken up by the engineer, who sees to it that the adjustment or restoration is made. Besides this the machines are regularly inspected and overhauled whenever need is evident.

A careful record is kept of the performance of each truck, and this is shown by a "Daily Trucking Sheet" which gives the number of the truck, the name of the driver and date and each load taken out in half, quarter and sixth-barrels, whether it be ale or bottling beer, the person who did the shipping, the number of the route, the time of leaving and returning, both morning and afternoon, the time of each trip, the reading of the odometer in the morning and at night, the mileage, the gasoline consumed in gallons, cylinder oil used in pints, the quantity of grease used, the weather and the road conditions. It will be noted that this is a combination blank and can be used for both gasoline and electric machines. The blanks are printed on a heavy, tough paper and are perforated for loose leaf binding.

In addition to this there is another record of each truck that shows daily mileage and the work done, this including the date, the time of leaving in the morning, the time of return, the load carried, the name of the driver, the odometer total and the mileage for the day. This is kept in a book that contains a statement for the year. In addition to this there is a record kept of each tire, this showing the date of purchase, the factory number of the tire, the license number of the truck on which it was in service, whether the truck is electric or gasoline, the date of installation, the name of the make, the record of the odometer when installed and the reading when removed. Thus the company has a note of each tire in use and can compare these as desired, as the tires are entered according to the serial number of each maker.

There are no trucks in service in New York that are better kept, and there are few that can show records of service that will compare with them, which is due to the care and attention given.

Six two-ton trucks were recently shipped to Manila, P. I., by the Gramm-Bernstein Company of Lima, consigned to the American Hardware & Plumbing Company, which has been one of the largest dealers in motor vehicles in the Philippines. This is said to be the largest shipment of trucks of a single size ever sent to the islands, and it is expected that the consignment of other models will follow.

HAUL TANK CARS WITH TRUCKS.

Novel Use of Two Couple-Gear Trucks at S. F. Bowser & Co.'s Plant.

S. F. Bowser & Co., Fort Wayne, Ind., one of the largest manufacturers of gasoline and oil storage plants and equipment in the world, utilizes two Couple-Gear electric trucks to haul tank cars to and from its plant and a railroad in that city. The main track is 2600 feet length and with trackage that includes two tracks at the railroad, three switches at the factory and another at a foundry the total length is about 3400 feet.

When the tracks were first laid and ballasted with cinders the ballast was level with the tops of the rails. On this ballast the trucks are driven, hauling one or more tank cars. The greatest number hauled has been seven cars, having 12,000-gallon tanks, four of these being loaded. There are numerous curves, three of which have a radius of 100 feet, but the trucks have each hauled two loaded cars around these curves. The cinder ballast has been well consolidated by the tires and the traction is excellent.

The statement is made that there has been no failure of the trucks to do the work required of them, and that with adjusting and systematic lubrication the machines have been found much more satisfactory than was believed they would be. The two trucks do the switching for which a locomotive would ordinarily be used, and the work is naturally much more economical and convenient.

The Y. M. C. A. officials in several large cities who have been conducting schools for motor car drivers, are planning to extend the scope of their work to embrace instruction in the care, operation and construction of commercial motor vehicles. With the large number of such machines in operation in nearly every line of business, hundreds of men who formerly drove horse trucks have been transformed into motor truck drivers with comparatively little trouble, but the increase has been rapid and complaints have been made in many cities of difficulty in securing competent, reliable men. The proposal of the Y. M. C. A. is expected to meet a responsive chord among many motor vehicle owners.

The city of Toronto, Can., was recently the scene of a horse show. The exhibit in itself was in no way remarkable, for Canada has long been noted for the quality of horses it produces, but as a demonstration of the rise in favor of the motor car it was a unique and important event. Not only did hundreds of patrons of the show use automobiles in visiting the building in which the horses were exhibited, but commercial vehicles played a very important part in the preparations for the display. All the lumber and other materials utilized in the special rings and tracks were hauled by motor trucks, of which there are a large number in use in the Canadian city.

SINGLE WHEEL DRIVEN CART.

Electric Wagon Designed to Replace the One-Horse Equipment for City Work.

The Eldridge Manufacturing Company, 178 Devonshire street, Boston, Mass., is building regularly a type of machine that was first seen at the Boston truck show, where the exhibit attracted much attention because of the departure from conventional practise. The type was first originated by the chief engineer of the Third Avenue Railroad Company, New York City, who conceived its use for the haulage of ashes and the construction was improved upon by the Eldridge company.

The machine illustrated is the first built and it is in the service of the Metropolitan Coal Company, being used for all purposes where a single horse and cart could be used. The capacity is 4000 pounds and the greatest speed is five miles an hour. The chassis frame is a steel angle that is "necked" from the centre cross section forward, the angle being curved to supply the usual front cross member, and it is continuous from the rear cross member. This frame has a slight "lift" at the forward end. The frame is mounted on a solid axle.

The front end of the frame carries a heavy cast steel plate, in which is cast a base for the fork or yoke that is supported by the front wheel. This plate is bolted to the frame. The driving wheel is mounted in a fork practically the same as is the front wheel of a bicycle, and the axle on which the wheel revolves is fixed in the ends of the fork. On this axle is installed the motor. The motor is approximately three horsepower and it is built to sustain about 300 per cent. overload temporarily. The ends of the armature shaft carry pinions that mesh with racks formed in the outer edges of the discs that form the wheel and the reduction is 24:1. On either side of the wheel are brake drums with external contracting brakes operated by a pedal and connected with cable so that the braking influence is equalized.

The fork above the wheel has a heavy shaft that exactly fits the base bracket of the plate, and a collar and a large nut that threads onto the bracket retains the shaft. On the upper end of the fork shaft is mounted the 22-inch hand wheel, and there is no bearing, but the shaft can be turned easily in the plate. Below the main frame, back of the front wheel and forward of the rear axle is the battery cradle. This cradle is loaded from the side, the sides being removable. The cradle is supported at the corners by heavy lugs that are carried on four guides, with helical springs above and below the lugs, this protecting the cradle against road shocks or stresses. The controller is mounted upright at the left side of the frame, this being of the street car type and fitted with a removable lever. The dash is a curved piece of sheet metal that is placed as a protection of the driver in the event of storm. The driver's seat is built for one and it is supported on full elliptic springs.

Directly over the rear axle are the brackets attached to the frame that carry the body. The body is heavy sheet metal and it is supported by a bar, the ends of which form trunnions that turn in the brackets. The trunnions are carried on helical springs that are compressed when the body is loaded and which have sufficient strength to prevent the body rattling when unloaded. The body floor slopes forward from the rear to the centre, and when dumped this section is vertical, insuring the complete discharging of the contents. The body is so balanced that it can be lifted easily when loaded, and when dumped the rear edge clears the ground by several inches.

The Electric Front Wheel Driven Cart Built by the Eldridge Manufacturing Company, Boston, to Take the Place of the Single Horse Equipment.

The front wheel can be turned so that the machine can turn as on a pivot, this permitting its use in very small spaces, where no horse vehicle could be worked, such as alleys, in courts and the like. The battery capacity is sufficient for 25 miles, and the power of the motor will pull the cart loaded through soft earth or other material, and it can be used on any grade up to eight per cent. with much economy. In the service of the Metropolitan Coal Company the cart is used for delivery of coal within a radius of two miles, and it has been found to meet a very exacting requirement with full satisfaction.

The mileage capacity of the machine is about twice that of a horse cart, and with the saving of a driver's wages it is expected that it will prove to be decidedly economical.

TIRES FOR ELECTRIC VEHICLES.

Manufacturers' Representatives Maintain That There Should Be Collaboration Between the Tire and Truck Makers to Produce Definite Standards of Production.

OF SPECIAL interest was a regular meeting of the New England section of the Electric Vehicle Association held at the Edison auditorium, 39 Boylston street, Boston, the evening of June 19, the subject for discussion being "Tires for Electric Vehicles," at which time several short papers were read and there was a great deal of general discussion relative to the quality and size of tires suited for different types of machines. The consideration was with relation to shoes for both pleasure cars and service wagons, but much of the time the references were particularly directed toward the latter types.

The meeting was presided over by Fred M. Kimball, and he appointed a committee of three to represent the association in the preparation of a paper to be read at the meeting of the New England section of the National Electric Light Association in September, this being the same committee that represents the Electric Motor Car Club of Boston.

The first paper was read by Alexander Churchward, a well known engineer, who is now connected with Gray & Davis, but who has been particularly active in research and experimental work for the association, and who has given a great deal of attention to the composition of tires suited for electric machines. This paper was as follows:

The subject of tires for automobiles is a very interesting and somewhat complicated one. No doubt most of you realize that tires make a very big difference in the energy consumption in watt-hours a ton-mile; i. e., in other words, the mileage your vehicle will make depends largely on the make of tires used.

The tire has the greatest influence of any part on the mileage. To illustrate this I will give the result of some tests on hard, level asphalt, and using data collected from eight different makes of tires: Taking the Palmer, single tube, as a unity: No. 2 tire takes 15 per cent. more; No. 3 takes 32 per cent. more; No. 4 takes 33 per cent. more; No. 5 takes 43 per cent. more; No. 6 takes 58 per cent. more; No. 7 takes 63.5 per cent. more. All the above are known as electric special tires and cover some of the best known makes.

The standard, pneumatic, gasoline tire takes 69 per cent. more; while the solid tires, compared with the unity tire (the Palmer, single tube) take from 42 per cent. more up to the extreme of 110 per cent. more. A very well-known solid tire compares very favorably with some of the special electric pneumatics, by taking only 54 per cent. more.

Some special tires of the "block" type have been built that take only 40 per cent. more; but I believe that it is not due to the special construction as much as to the good material which they put into this special construction of tire to make it hold together.

It is obvious that I cannot mention the names of the different tires used in the above test, as it would be unfair to the tire makers.

I took one electric runabout, and with 30 cells of 15 thin plate battery—and with Palmer tires—I could get as high as 115 miles at 16 miles an hour. These were double tubed. While with another make of special electric tire I could get only 82 miles at 16 miles an hour. With ordinary pneumatics I could get 68 miles at 16 miles an hour; while with a good grade of solid tire I could get as high as 68 miles at 16 miles an hour. So you can see what effect the tires do have on the mileage of the vehicle.

Some time ago I took up with the standardization committee of the Electric Vehicle Association the matter of standardization of tires by tractive effort per ton-mile; i. e., the amount of power to transport a given load at a given speed; and I believe it will be accomplished sooner or later, and that we will be able to get a standard tire which will put everybody on the same basis as far as mileage is concerned.

At the conclusion of the paper it was suggested that it would be well to hear all the papers and have the discussion relate to all of them, and this course was followed. The second paper was read by James E. Hale of the experimental department of the Goodyear Tire & Rubber Company, which dealt with the subject from the engineer's point of view. The writer's observations were more general than specific, he pointing out that tire manufacturing was a problem that presented many aspects. What was wanted by the users of tires was high efficiency and long mileage, and the makers were endeavoring to meet these requirements so far as was possible. The highest quality with reference to efficiency in the consumption of energy is not generally realized in the tire that has the greatest endurance, for the composition of the two must necessarily be in every way different. There is with all tires the element of internal friction to be dealt with, but as a rule heating is more marked in pneumatic shoes. He went on to demonstrate that when high resiliency is realized in a tire it is not enduring, and when extreme endurance is obtained the resiliency is lessened, it being impracticable to obtain both qualities. He believed that the conditions of overloading and under inflation were very largely responsible for what was regarded as inefficiency and failure, and that it was absolutely impossible to build a tire that would endure unless it was used within the limitations comprehended in its design. One of the greatest causes for tire destruction is the continued impact with the inequalities and obstructions of the road. The tire companies were compelled to give high standards and then the shoes were not used as they should be used to justify the expectations of the users.

T. H. McGiehan, general manager of the Motz Tire & Rubber Company, Akron, O., commented on the requirements with reference to tires, and he maintained that the absence of a standard by which it would be possible to determine resiliency was a condition that complicated the problem. The manufacturer could produce exactly what might be desired with reference to resiliency, but through lack of a standard or standards it was impossible to produce what might generally meet all requirements. If the vehicle manufacturer established precise specifications with reference to resiliency the tire maker could produce what would meet them, but this need did not appear to be realized by any of the car or wagon builders. From the viewpoint of the manufacturer of tires it was manifestly impossible to have compounds and proportions that would each be adapted to so widely varying requirements, and unless there were complete and definite understanding there could be no change.

The following paper was read by W. W. Duncan of the Hood Rubber Company:

Tires for electric vehicles may be divided into three classes: Pneumatics for light vehicles, cushion (such as the Motz) for

light vehicles, and solid tires for trucks. We deal entirely with the last named class, particularly for trucks weighing with load 8000 pounds and over.

The electric truck man looks at a tire from an entirely different standpoint than a tire manufacturer. It is to his interest, from a point of salesmanship, to have a truck give a maximum number of miles per charge of battery. To do this he has raised his batteries higher up, he has changed the design of the truck and he has chosen his tires from this standpoint.

Now from the tire man's point of view what the user desires is greatest miles per tire. Therefore the tire manufacturer endeavors to get on the proper size tire to carry the load at the speed required.

Rubber is a peculiar substance. It and any compound of it is practically non-compressible. Therefore under a load a solid tire must compress into some other shape than that in which the tire is built. The amount which is displaced varies with the composition of the compound and the load. Various shapes are recommended for better and worse, but the above fact holds true. Therefore, if the tire does not contain sufficient rubber body under the wheel to support the load it will compress so that the movement of the rubber compound in displacement is greater than the adhesion of the softer rubber to the hard base. When this happens, and it always happens if the tire is too small, friction develops, at each revolution of the wheel, in the body and the tire is soon gone. Again speed comes into it.

The rubber compound takes a certain amount of time to return to shape and if it does not have the time during the wheel revolution, the next shock on the road causes too great a displacement and a similar break as before. And now comes the point I want to bring up. The proper size of solid tire to carry the load and stand the speed does not usually give the greatest mileage capacity charge of battery. Therefore, if you choose tires from the truck makers' standpoint of mileage delivered from battery you are doing an injustice, not only to the tire makers, but also to the users.

Having an insufficient amount of rubber under the wheels not only causes quick tire deterioration, but also does not properly protect the truck mechanism from shocks and increases the user's repair bills and tire expense. I know of cases where a truck weighed 10,500 pounds and carried a dead load of 10,000 pounds, or a total of 20,500 pounds; 60 per cent. or 12,300 pounds, was on the rear wheels, or 6150 pounds on each rear wheel, which was equipped with dual five-inch tires. Our five-inch tire dual, which I believe is rated as high as any, will carry a maximum of 5500 pounds, and we recommended six-inch duals which would carry 8000 pounds, giving a good leeway. This increased the truck user's tire cost about $36 per tire, or $144 per truck.

The load on the front wheels was 8200 pounds or 4100 pounds on each wheel, and the truck was equipped with seven-inch tires, which would carry 4600 pounds, these being ample. Why were not the rear tires properly sized, as were the front? The owner naturally balked at putting on the proper size tire at extra expense, which also necessitated a change of wheel, although he knew he was not getting tire service, whereas if the truck had been properly equipped in the beginning he would not have thought of it. As it is he is changing from one make of tire to another, trying to get satisfaction which will never come, and cursing trucks in general.

Now what I want to point out is this: There must be collaboration between the tire manufacturer and truck maker; not between the tire salesman and the truck maker. The tire salesman often advocates a too small tire to make a sale. In this he is wrong and may mislead the maker. But the maker is apt to meet him half way because it decreases the cost in the truck. I venture to say that in more than 60 per cent. of the trucks we equip we have to change the felloes on the wheels to apply the proper sizes of tires.

I know of one case in Providence where we took up the tire equipment of a gasoline truck after every other tire man had given up the work. The truck was fitted with five-inch dual tires on the rear wheels. The owner overloaded the machine and it was driven at excessive speed. For an experiment we put on five-inch tires. These were torn from the bases in 2300 miles. We then put on 5.5-inch dual tires and the owner is going to realize about 5000 miles. This man needs six-inch dual tires, but we cannot fit them, because the truck is so designed that the felloes would interfere with the chains. We cannot properly equip the truck and the owner cannot understand why the truck maker did not, and consequently the owner is dissatisfied with truck makers and tire makers. Therefore, please remember in equipping your trucks to put on the proper size of tire to carry the loads, even at the expense of less mileage per battery charge. This result will be offset by the fewer repairs on the truck, increased tire mileage and general satisfaction. At the present rates for charging batteries with electricity the cost is cheaper per mile than is the cost of rubber tires.

Following this paper the discussion became general. Mr. Kimball sought to establish that the variance in wear with tires for gasoline and electric vehicles was due very largely to the difference in character of propulsion, the impulses of the explosive motor causing a succession of stresses upon the tread of the tire where it contacted with the road surface. The electric motor, however, has a uniform torque and there is not the variable strain caused upon a tire tread. It was to this condition, peculiar to each prime mover, that he attributed the greater endurance of tires fitted to electric machines. As he expressed it the action of the electric motor was uniformly even and the stresses upon the tire of the electric vehicle were the better resisted by the tire structure.

Mr. Churchward stated that the tests referred to in his paper were made with recording instruments, showing the exact consumption of power and the resilience of the tires, and the trials were made with the same vehicle over the same roadways, so that the results were variable only through the qualities of the tires. He believed that the method chosen was the only one that would determine precise results and establish qualities.

Mr. McGiehan suggested that the determination of the resiliency of the tire by the elasticity as shown by the bounce, in the same manner as steel is tested by the sclerescope, might be satisfactory, because elasticity could only be obtained through compounding, but to this Mr. Churchward replied that recording instruments were the more definite and reliable.

Mr. Hale maintained that to his mind the wear of tires was, aside from the abrasive influence, due entirely to the continuous impact with road inequalities, and that this condition could not be met with only by having the surfaces of the highways smooth and even, for it was not possible to make a tire that would have all the qualities and resistance to wear. It was practical to make a tire that would resist abrasion, but it was extremely difficult to attach an elastic and yielding material solidly to a base. The base of the tire must be such as will remain firmly fixed upon the wheel, and the strains of tractive effort, braking, and the like are resisted by the tire compound. He believed that with extreme mileage for electric vehicles the construction would not endure as well.

He said that he did not believe he was making too strong a statement when he said that the tire manufacturers were "sick" of making guarantees, because of the many conditions which they could not control, and he was of the opinion that there would shortly be a disposition to abandon guarantees, which would result in compelling the vehicle builders to furnish better tires, and it would be necessary for the owners of machines to require their drivers to be careful and economical of the tires.

Mr. Duncan believed that the vehicle manufacturers were inclined to under rather than over-tire the machines, and instead of making certain of a reasonable margin that would insure greater mileage and increased endurance they were willing to leave this to the tire manufacturer and the truck owner. Not only this, often there was no provision made for the fitting of shoes of sufficient dimensions.

H. L. Stockbridge, engineer of the Hood Rubber Company, maintained that Mr. Duncan's contentions were well established, and that while the tire manufacturer made his products to meet certain conditions, there was no definite standard by which the purchaser

of the vehicle could be assured that the tires fitted by the maker were what would give the best and most economical results. In fact there was an absence of that knowledge that should obtain, and there ought to be the standards by which the interests of the tire manufacturer, the vehicle builder and the owner would be best conserved.

The endurance of block tires for trucks was brought up and Day Baker, district manager for the General Vehicle Company, stated that he was decidedly interested in a test that had been made because of the supposition that block tires were not as enduring as solid tires. A truck used in coal haulage was fitted with solid tires and these were worn out in nine months, but this same machine was equipped with block tires and these had been running for 22 months and were not yet unserviceable. Mr. Baker said in reply to a question that the tires had been changed with reference to wheel position and that careful record had been made of the mileage and the work done by the machine.

Col. E. W. M. Bailey said that what was wanted more than anything else for electric vehicles was tires that would be specially adapted for the service and which would have qualities that would combine high mileage and endurance. He was of the opinion that there was a decided difference in the effect of transmissions so far as gasoline and electric machines were concerned, and there was no doubt in his mind that it was impracticable to obtain the same results from tires built for the two types of machines. In other words, there ought necessarily to be standards for each class of tire that would be understood by the different interests, and these could be used so that the best results could be obtained.

NEW ENGLAND CHARGING STATIONS.

Garage and Emergency List Prepared by the Boston Electric Motor Car Club.

The Boston Electric Motor Car Club has published under the title of "Pastime Journeys for Electric Automobiles" a booklet containing much desirable information, which has been placed on sale for the benefit of the motoring public. The contents include a summarized statement entitled "The Electric Automobile Defined," by H. F. Thomson of the electrical engineering department of the Massachusetts Institute of Technology, which sets forth the simplicity and ease of operation of electric machines.

This is followed by "The Why of the Electric Motor Car Club," which is stated to be a co-operative organization of all those in New England who are interested in the promotion of the electric motor car, this being an evolution from an association with a membership composed entirely of manufacturers and agents of electric vehicles, batteries and accessories. Among the benefits obtaining through membership are maps and routes for New England tours, charging station information, advice as to garages in which electric cars are given proper attention, the co-operation of the Boston city authorities in the establishment of parking spaces in the down-town sections of the municipality, interpretations of new laws and regulations governing the operation of motor cars, and the club is planning the establishment of a garage especially for the benefit of theatre patrons that will have washing and charging facilities, is now considering the proposal to inaugurate co-operative insurance, the instruction of mechanics and garage hands, the inauguration of a registry of motor truck drivers and the development of a bureau of information that will record data of electric vehicles and their mechanical construction that will serve motor vehicle owners.

The booklet contains routes and maps from Boston to Plymouth, Mass.; Boston to Portsmouth, N. H.; Boston to Worcester, Mass.; Boston to Springfield, Mass.; Boston to Providence, R. I.; Boston to Newport, R. I.; Boston to Lowell, Mass., and Boston to Lawrence and Amesbury, Mass., the longest distance routed being 95 miles. The list of charging stations shows that there are 208 of record, of which 28 are in Connecticut, Maine 25, Massachusetts 121, New Hampshire 17, Rhode Island five and Vermont 12. This does not include all of the stations that are available, and the list is being added to very rapidly. The stations are those of public service corporations, public garages and differing power plants where energy is available. The voltage, amperage and hours when service can be obtained is stated with reference to each station, and emergency stations are defined with the instruction that to these the probable time of arrival should be stated by telephone. Assurance is given the owners that the garages and charging stations listed can be depended upon for reliable and efficient service. These charging stations are available for all users of freight carrying machines and a copy of the list is especially useful for the driver of any vehicle sent out for a trip which includes more than the usual mileage.

William E. Metzger, who was a director of the Automobile Chamber of Commerce representing the Maxwell Motor Company, retired from that position and was immediately elected a director of the body as the representative of the Argo Electric Vehicle Company, Saginaw, Mich. Mr. Metzger has long been identified with the industry as a builder of gasoline machines, but this is his first association with a manufacturer of electrical vehicles.

"Electric Vehicles" is the title of a magazine which has succeeded "Ignition," published by the Electricity Magazine Corporation at Chicago. As the title implies the publication is given over to differing subjects that have to do with vehicles used for pleasure and service, and as may be assumed these are regarded from every aspect. The magazine is illustrated freely. Considerable attention is devoted to various electrical organizations, and there are, in the initial number, specifications of some of the best known pleasure machines.

ELECTRIC VEHICLE PRACTISE.

Characteristics of Design and the Constructional Details of the Standard Westinghouse Motors—Features of the Motors Used in the Couple-Gear Wheels and the Walker Rear Axle, Both Built to Endure Unusually Severe Stresses.

(By William W. Scott.)

THE description of the processes of manufacture of electric vehicle motors by the General Electric Company has been made with a view of making known the extreme care taken to insure factory perfect machines. This statement can be applied to the production of other manufacturers, for it is purposed to send out motors that have been found to meet every test, and to insure to the vehicle builder and the user what will afford long and continuous service under the most exacting conditions.

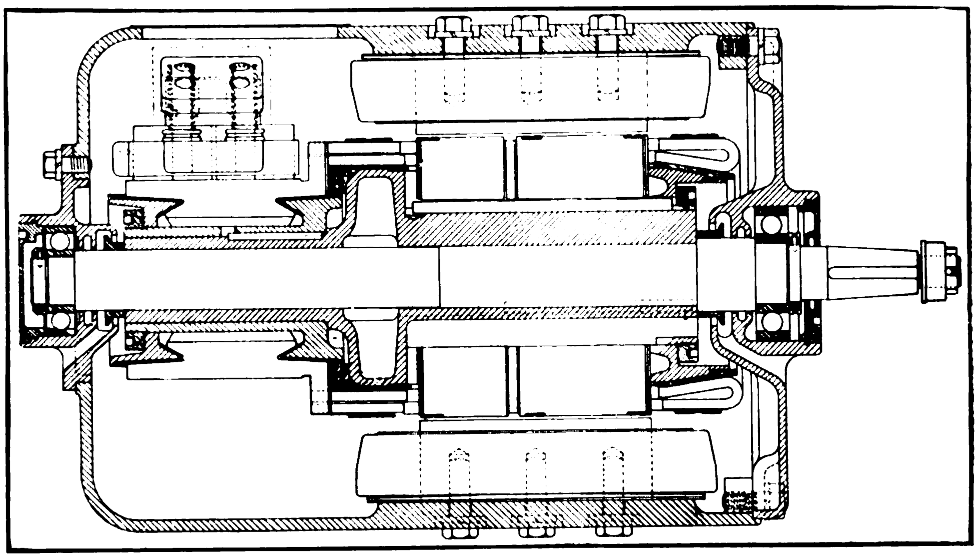
One of the largest builders of electric vehicle motors is the Westinghouse Electric & Manufacturing Company, the machines of this company being recognized as standard, and they are used by a number of well known manufacturers of cars and wagons. With reference to these motors what has been stated as to engineering and design may be accepted as fact, these being developed with a view of securing high efficiency, overload capacity, endurance and dependability, and the design has been worked out to economize space and insure simplicity and accessibility. These are built with capacities suited for varying types of batteries, voltage and mechanical systems as determined by analyses of the results from prolonged observations and study of actual operating conditions.

An examination of the accompanying drawings will show that the construction of the Westinghouse motors coincides closely with the General Electric machines so far as the application of principles is concerned, but there is, of course, a variance in detail of design.

The Westinghouse motor has the cylindrical frame that has been accepted as affording the greatest strength and which has the minimum bulk, for space required for installation and weight are two important factors. This is also a steel casting which is formed with the commutator end integral, there being increased thickness of the shell for approximately half the length of the frame from the pinion end, and this belt serves as a seat for the field pieces and coils. The frames are made in different sizes to standard patterns. There is at the pinion end an internal flange that serves as a seat for the end plate and to which the plate is bolted.

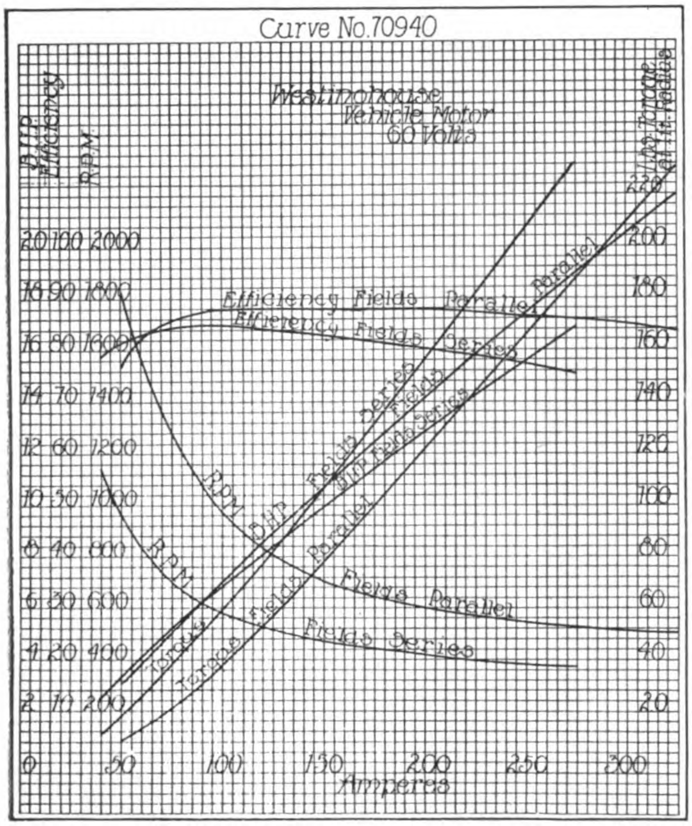
The end plate is a casting that has an opening for the shaft end through the centre, and this opening is shaped to carry the bearing and to conform closely to the shaft, there being three flanges between the bearing and the armature to prevent the flow of lubricant, while a drain insures against an accumulation of lubricant in a sufficient quantity to work into the motor case. At the commutator end of the motor there is an end bearing plate that is similarly formed and which carries the bearing, the end of the plate being closed by a cap screwed into the opening and secured by a cap screw.

The frame is carefully machined internally and roughly machined externally, or to any dimensions required for accurate mounting. There is in the shell at the commutator end a hand hole through which the commutator and the brushes may be inspected, and this is closed by a plate retained by screws, so that when assembled the frame is dust and water tight and is amply protected. A glance at the drawing will show the manner of securing the bearings in which the armature shaft is mounted.



Sectional Drawing of a Standard Westinghouse Vehicle Motor, Showing the Proportions and Relations of the Armature, Field Coils, Field Pieces, Bearings, Etc.

The armature is designed to produce definite electrical results and has specific proportions. It is a ventilated type and the core is composed of a series of thin sheets of steel that are cut in a die, having a central opening and a series of rectangular slots equidistant around the periphery, these having a depth about twice the width. The steel sheets are coated on either



The Performance Curves of a Standard Westinghouse 60-Volt Motor.

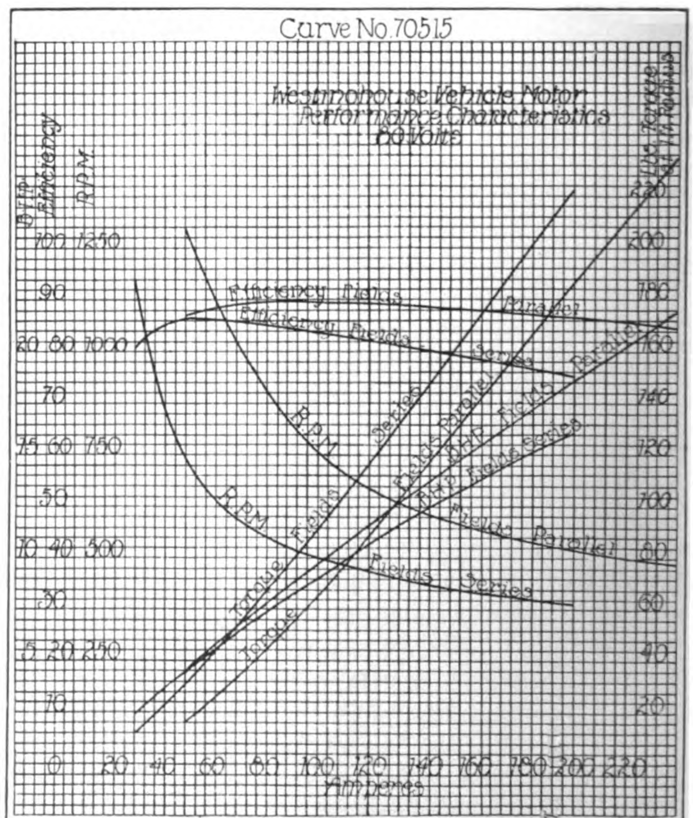
side with insulating material. The required number of these sheets are arranged on a cast iron spider and securely clamped, the spider having a collar, and at the pinion end of the spider is a plate that is retained by a collar that is seated firmly against the plate. The spider is pressed upon a steel shaft and is secured by a longitudinal key.

The core when assembled has the series of longitudinal channels into which the windings are placed, these being loops of groups of rectangular wire with the loop ends laid on the end plate, and the free ends are soldered to the inside ends of the commutator segments. These loops are wrapped with material that, when impregnated with a compound, perfectly insulates them, and the windings are firmly bound by a series of windings of wire that are soldered together, there being five of these bands encircling the armature. The commutator is assembled on a cylinder of molded mica with mica strips between each of the wedge-shaped copper segments, and the assembly is clamped by a collar at the end of the spider that is firmly screwed to its seat. The ends of the winding are soldered to the commutator bars and perfect contact is insured. The completion of the commutator is when the mica strips between the segments are milled below the surface of the copper bars, the channels being about .0625 inch depth.

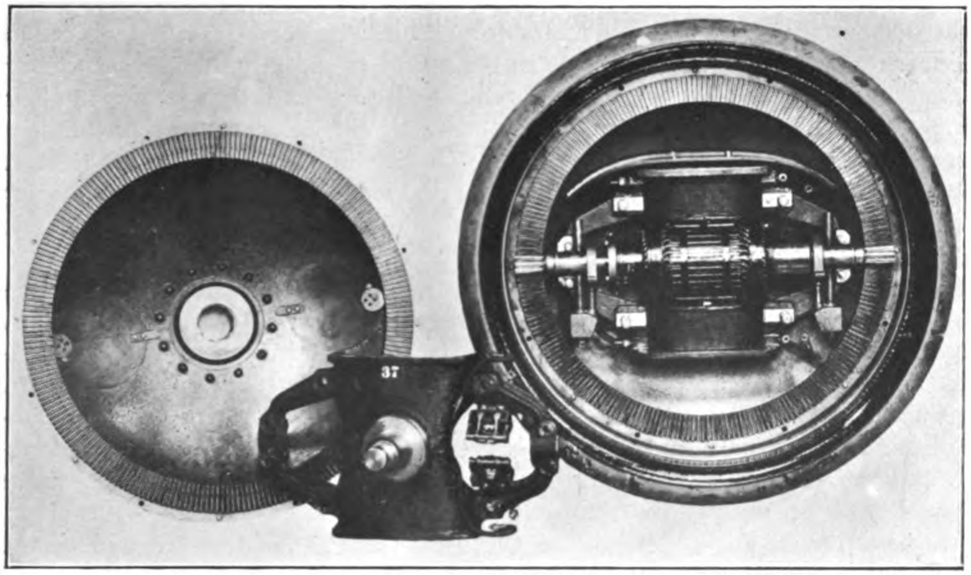
The rectangular wires or straps from which the wiring coils are formed are a high quality of copper, and these are shaped on formers so that all are uniform in size and weight, the insulating material being very carefully applied and sufficient to insure complete insulation. The windings extend beyond the core channels and are supported by the collar of the spider and the end plate, and are well protected by the five wrappings of soldered steel wire. The commutator is maintained in position by a longitudinal key. Examination of the sectional drawing will show the manner of supporting the windings, the connection of the windings and the commutator segments, the collars clamping the different elements of the armature to the spider, the keyways, the shaft and its bearings. The shaft is made from a large section of axle steel and is ground to exact dimensions, and the bearings are fitted carefully.

In the construction of the armature the design calls for a large proportion of copper, this insuring a high degree of conductivity and consequent efficiency. The core is built to have a comparatively low resistance.

The field or pole pieces are laminations of very thin sheet steel that are assembled in a registering former and are riveted under pressure, each sheet thus being in positive contact, there being no insulation of the sections. The fields are shaped with the face wider than the base, there being flanges or horns at either side which considerably increase the surface area. As will be noted from the sectional drawing the field pieces are the same length as the armature core, and each pole is retained to the seat by three cap screws seated in recesses in the motor frame. The backs of the field pieces are carefully machined to fit the contour of the seat. The pole tips are chamfered in order to regulate magnetic fringing and to reduce the noise from this cause to a minimum, but the change in the curvature is such that the pole face presents an unbroken surface to the armature core.



The Performance Curves of a Standard Westinghouse 80-Volt Motor.



The Couple-Gear Motor as Installed in a Wheel with the Outside of the Motor Case Removed, Showing the Armature, and Pole Pieces.

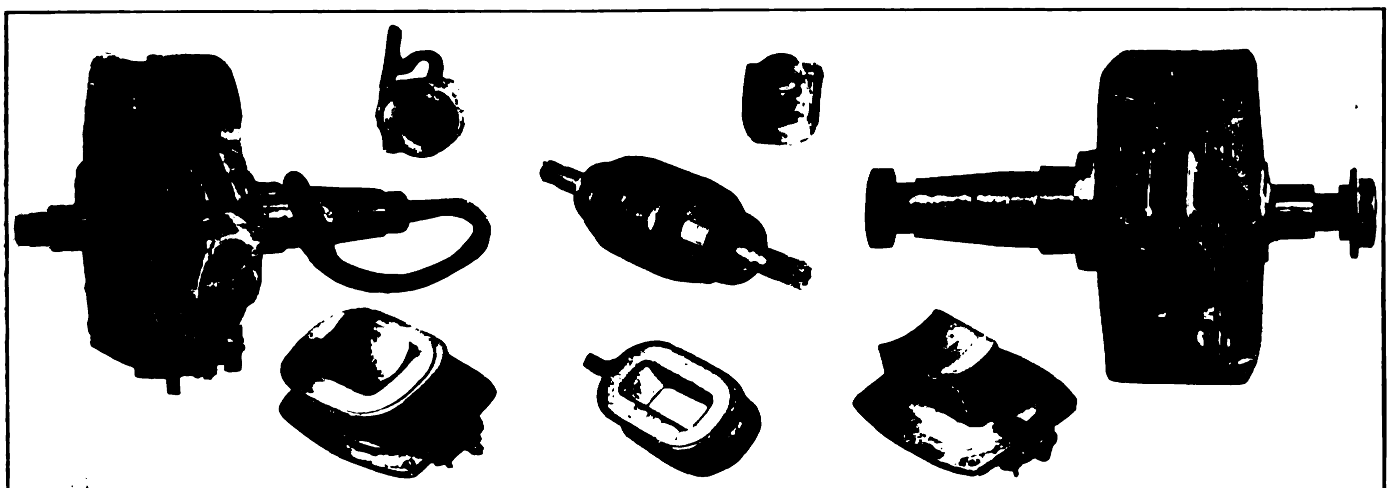
are easily accessible. The brushes are of graphite that have braided copper shunts mechanically connected with them.

In connection with the descriptions that have been made of the General Electric and the Westinghouse designs it will be noted that the former is constructed with a solid armature and the latter with what is known as the ventilated armature, there being several channels extending through the core so as to afford a greater area exposed to the air. The purpose of the ventilating channels is to secure radiation and to reduce the temperature of the armature, for heating from the electric energy is a natural consequence. Ventilation is very general in motor construction, but there is a difference of opinion with motor designers as to the value of ventilating when a motor is enclosed in a dust and water tight housing, for there is very little if any change of the air about the armature and there is not a sufficient volume to have material influence. There is no well established law governing this construction, each designer having his reasons for the particular construction which he favors.

Some of the designers maintain that the proportions of the motor, its windings and other elements govern the heating, and that this can be well controlled through this design without reference to exposure of surface area of the core, while others believe that the ventilation is an insurance that should be incorporated in the construction. Ventilated motors are generally utilized in Europe, such design being seemingly the more favored, but in America there appears to be a greater tendency to use the solid core type. As there is assurance by the manufacturers that the motors, whether or not ventilated, will meet all demands

The field coils are nearly the length of the armature windings and these are made up of a very fine grade of copper wire of rectangular section that is wound on formers or molds. The wire is wrapped with treated insulating tape and the coils are impregnated with an insulating compound. The coils are proportioned to have a large radiating surface. In the assembling a flat steel spring is placed between the coil and the pole seat, and above the coil and between it and the pole flanges is placed a flat brass shield that prevents the insulation of the coil directly contacting with the flanges. The purpose of the spring is to prevent movement of the coil either from magnetic pull or mechanical shock and the shield is to prevent wear on the insulation. In other words, this construction eliminates any possibility of abrasion of the coil and protects it fully.

The shaft is mounted on ball bearings of liberal proportions and the bearing housings are designed for the use of vaseline or any standard ball bearing grease that may be used as a lubricant. The two brush holders are a radial sliding type, accurately spaced and securely bolted to the frame, being so located that they



The Couple-Gear Motor Assembled and Removed from the Wheel, and the Armature, Pole Pieces, Field Coils and Bearings Disassembled.

legitimately made upon them, there is no need for the purchaser of a vehicle to concern himself with this detail.

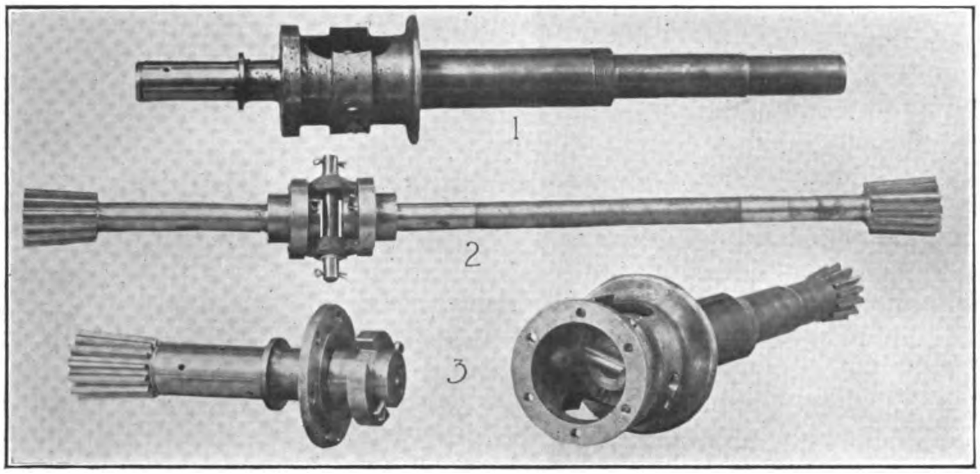
Where motors are not exposed to accumulations of dust or other abrasive substances, as are those used on vehicles, there is no cogent need of enclosing them and there is always the cooling influence of the circulation of the atmosphere. Not only this, the open motor is the more easily observed and given attention, which may be considered an advantage, yet at the other hand the enclosed motor may be run for months with practically no attention other than lubrication of the bearings at intervals of perhaps six months. Generally stationary motors have open frames and there is perfectly free circulation of air, and this is true of large generators and dynamos.

It is seldom that any other form of armature construction is used for a vehicle motor than those that have been described, and the reader may accept the two types as being almost universally adopted. As has been stated, different qualities are sought by designers and the variance while apparently very slight may produce a very important effect. For instance, the channels in the core in which the windings are laid may have a very slight variance from exact parallelism with the shaft, which is intended to minimize the noise of operation. High speed motor armatures are generally longer and smaller in diameter, the windings having greater length, this construction being regarded as being better resistant of the centrifugal force. Generally speaking, however, the core of the motor intended for the vehicle has about the same diameter as length, though this is not always found to be the case.

Taking the two designs of motors described it will be noted that there is a disposition by designers to follow with extreme care principles recognized by electrical engineers, and there is a similarity of construction that follows the application of those principles. These two concerns have standardized the vehicle motors and have carefully perfected them, but where installations vary the forms at times differ. Reference has been made to the manner of mounting the motors in the chassis, and among these can be mentioned the single motor from which the drive may be by a reduction chain to the sprocket of the jackshaft, by a shaft to the bevel gear of the jackshaft, by a reduction chain to the driving shaft, by reduction gearing to the driving shaft, by a reduction chain and reduction gearing to the differential gearing, by double reduction gearing to the wheel rims, and by a single reduction gear to the periphery of the wheel flange.

Any of the forms of motors to which reference has been made may be used for driving a machine of any size. Obviously the only moving part of the motor is the armature and the only possibility of wear is at the bearings and the commutator, but with normal attention this wear is practically negligible. The single motor may be installed in different positions, back of the jackshaft and driven by the shaft or single silent chain, forward of the jackshaft, at the forward end of the chassis, amidships or at the rear end, and either transversely or longitudinally.

With one type a motor is installed within the single front wheel, and with another the motor is contained in the housing of the rear axle.



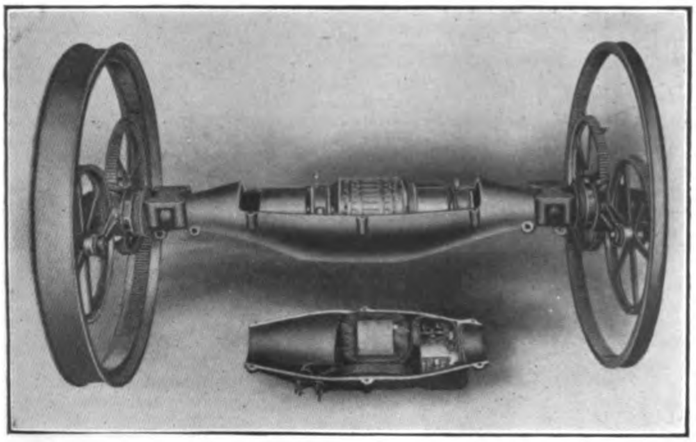
The Couple-Gear Armature Shaft and Driving Shaft: 1, the Armature Shaft or Sleeves; 2, the Driving Shafts and the "Evener"; 3, the "Evener" Separated, Showing the Pin and Connecting Bars That Serve as a Substitute for a Differential.

The design of the motor contained within the wheel is intended to simplify chassis construction and to obtain all the qualities that are desirable. It is a two-pole type and the motor is built with a long and a short shaft projecting at right angles to the armature from the frame. The long shaft is mounted in the axle and firmly fixed and the wheel revolves on it, the outer end of the axle fitting into a recess in the outer flange and affording a solid bearing. This frame contains the pole pieces and the armature, and it also supports the armature shaft bearings and the brush rigging. The armature is built to follow the principles of the General Electric and Westinghouse types, and it is assembled on a hollow steel quill or tube. The driving shaft extends through this quill and it is secured to the quill by a steel pin that is carried to short steel bars. The ends of these bars are fitted into slots in flanges or collars on the ends of the shafts, in which slots the ends of the bars may move slightly. The outer ends of the shafts carry integral pinions that mesh into the racks in the wheel flanges, and the shafts are so mounted that one pinion engages one rack and the other pinion the other rack, so that there may be a driving effort applied at either side of the wheel and with the full power of the motor. The movable bar connecting the shaft sections is known as an "evener" and it is a patented device, it taking the place of a differential gear, and while perhaps not mechanically as efficient it serves the purpose of relieving the shafts of starting stresses and has the merit of being very economical.

Were the shaft solid there would be a very severe strain when the motor was started and the evener compensates this with decided success. This is the Couple-Gear electric motor system of driving and it has been adapted to light runabouts and to heavy trucks with exceedingly practical results. The reduction in this direct drive is 24:1 for constructions intended for heavy work.

The wiring is carried through the hollow long axle stub to the motor. The brushes are mounted on the outer side of the motor frame. As will be noted in the illustration the evener is at one end of the armature shaft and the commutator at the other, and these are reached for inspection by hand holes in the outside wheel flange that are covered with large, easily removable plates.

The motor used in the machines built by the Walker Vehicle Company is contained within the housing of the rear axle, the armature being built on a hollow shaft or sleeve, into which the long driving shaft is fitted. The armature sleeve is fixed to the driving shaft. The illustration shows this construction.



The Motor of the Walker Vehicles, Which Is Placed in the Housing of the Rear Axle, with the Cover Plate Removed.

As will be noted the commutator is at the right side of the axle housing and the differential is at the other. The motor is a four-pole construction, two of the pole pieces being mounted in the lower half of the housing and the other two in the upper removable section. This cover or plate also carries the brushes.

Both the Couple-Gear and the Walker motors differ from the others in that lubricant is placed in the housing and more than the volume required for the other types of motor is used. In neither case, however, does this character of lubrication affect the motor. With the Couple-Gear motor the evener, the bearings and the pinions and racks must be supplied with grease, and the Walker motor requires grease for the motor bearings and the differential gearing.

The descriptions that have been given do not cover by any means the numerous types of motor frame construction, some of which differ materially in appearance from those described. For instance, one motor used on a well known vehicle has a frame that is literally a frame beyond the commutator end of the armature, there being four large openings that are covered with plates that may be removed by loosening a series of cap screws. Others have frames that are designed for incorporation with the axles, these having trunnions so that the motors may be swung with the forward wheels, or firmly fixed in the event of being used for rear axles. There are also the constructions in which the worm and wheel is used.

In connection with the use of any motor it should be understood that it is designed for specific work and if it is used rationally it is remarkably enduring and requires practically no marked degree of attention. But efficiency demands that there be the least ratio of frictional losses. The transmission of power has been accomplished in different ways by diffent designers, and because of the necessary speed of the armature, reduction has been made through means that have been mentioned. Though the motors may be exceedingly enduring, location where they may be reached quickly and conveniently in the event of need has been sought by many vehicle engineers, and as may be assumed the design of the motor is not dictated by the engineer, although it may be adapted to meet his requirements.

The placing the motor in the chassis may require special fitments that the greatest efficiency may be obtained, and there is no agreement as to the best type or design, for one, two and four motors, and either front or rear or all four wheels are used.

(To Be Continued.)

S. G. V. MOTOR BANK WAGON.

Bay State Trust Company Takes First of These Vehicles Delivered in Boston.

The Bay State Trust Company of Boston has purchased a motor driven bank wagon of the S. G. V. Company, Reading, Penn., maker of S. G. V. cars. It is the first machine of its kind to be supplied in Boston by the company. A stock chassis has been used and the body follows closely the lines of a small limousine. The interior is steel lined, the lining being stained the color of mahogany.

It has been a very common custom for persons having silver or other valuables to place them in storage during the summer months, when town houses are to be vacated. The Bay State Trust Company has made a specialty of this class of business and with the new car the firm is in a position to call for and deliver such valuables, taking the entire responsibility for their safety from the time they leave the owner's door until they are returned to him.

A new automobile ambulance has been placed in commission at San Jose, Cal. The chassis is that of a Haynes car, made by the Haynes Automobile Company, Kokomo, Ind., and a special body, to meet the peculiar requirements of the service, was designed according to the recommendations of several of the leading physicians of the city. Since it was put in service the machine has met all the requirements to the satisfaction of those who were interested in it.

"THE IDEAL ELECTRIC GARAGE."

THE character of garage suited for the storage of electric vehicles was considered at the concluding meeting for the season of the New York section of the Electric Vehicle Association of America, the consideration being opened by the reading of a paper on "The Ideal Electric Garage" by H. M. Martin, who is connected with the H. C. & A. I. Piercy Contracting Company of New York City. In connection with this paper was discussion of differing topics aside from the paper itself.

The paper was in part:

If one were given carte blanche to design a perfect electric garage it would seem, off hand, to be a comparatively easy matter. Doubtless many automobile problems are more difficult; yet there is much food for thought, and many compromises have to be made before the ideal design can be adapted to working conditions.

Simplicity and cleanliness are the electric's prominent characteristics, and these ideas can be exemplified in an electric garage which will be complete in every detail and yet be in strong contrast to the more elaborate equipment, and larger space necessary to garage and repair gasoline cars. Just at the present time the electrics are enjoying a certain prominence before the public, and justly so, because of the increasing cost of gasoline and the decreasing cost of charging current. As far, though, as the price of fuel is concerned, it would be well to take the utmost advantage of this situation while it lasts, since the near future will see the successful introduction of a fuel heavier even than the present liquid that is by courtesy called gasoline.

The location of the garage should be central with regard to the places of business of its customers. Since customers are not usually promised in advance, other conditions assume greater importance. If possible it should be on a well paved street near a main artery of travel, and here we strike the first necessity for compromise, since property of this description will probably be too expensive. If there is any choice in altitude the lower should be chosen—in other words, at the foot of a hill rather than at its summit. For the same reason the ground floor should be only an inch or so above the sidewalk or street level.

This brings us to the building itself. The number of floors will be determined by a compromise between the cost of ground and the cost of additional vertical construction with all that that implies—elevators, etc. Particularly if there are many floors, the elevators (of which there must be at least two) will be of as high a speed as good judgment will allow, because on the elevators' speed will depend the number of cars that can be accommodated. This is true because of the fact that in a commercial garage practically all the cars have to leave the building between 6:30 and 8 in the morning. With three men to an elevator working lively, but not to the point of danger, it takes from 20 to 30 seconds to move a car on and off. If the average floor is 60 feet from the ground floor it means that to get one car down every minute and a half the elevator must run at a speed a little better than 110 feet per minute. This is all right for small cars, but if larger ones up to five tons have to use the same elevator then an automatic device should be installed, cutting out re istance in the elevator motor's shunt field and reducing the speed to about 60 feet. In this way the apparatus itself takes care of increased load.

Electric control from the car should, of course, be employed instead of the usual hand rope. The electric control precludes the possibility of starting the elevator by anyone not on the platform itself. Automatic gates will prevent, nine times out of 10, the serious accident of having a car fall down the shaft. This usually happens when the platform has been moved without the knowledge of someone about to back a car upon it, and who sees his error too late. If the car is pushed by hand, or very slowly under power, a comparatively light barrier will stop it; but if it has attained any considerable speed it is doubtful whether any of the devices at present in use would not bend out of their guides and become useless.

It is preferable to have no posts to interfere with the free movement of cars, though to leave them out will add materially to the initial expense and make the floors thicker and the whole building higher. If posts must be used let them be spaced with regard to the number and sizes of cars that are planned to stand between them. They should be provided with base guards, which will prevent damage to projecting parts of the vehicle. Wall guards are equally important, so placed that the tires will strike them before any part of the car can hit the wall.

Concrete floors should be painted with a preparation giving them a smooth surface, which is easily cleaned and saves the concrete from wear, and gritty dust from rising. These floors should be pitched slightly from the centre line down to the side walls, both ways, with gutters formed in the concrete along the walls so that washing may be done, if necessary, without moving the cars.

Lighting should be well distributed, and each floor's lights controlled in several groups for the sake of economy of current. Around the walls, at frequent intervals, receptacles should be installed for drop cords so that these need not be of an unhandy length. The wall receptacles should be of sufficient capacity to take care of a portable drill.

Large windows are a good feature, and should be placed to allow the maximum of light and ventilation. This means a high window, which has other advantages.

The heating system should be ample to keep all floors, where cars are stored, up to at lease 60 degrees during the coldest weather. This is essential in order to start the batteries out warm. A gasoline garage can get along with any temperature above 32 degrees, but not so with the electric.

The charging equipment, switchboard, wiring, etc., should be of approved type, solid and well erected. This apparatus is so standardized that no special remarks are necessary except to suggest that rheostats, being usually grouped as closely together as their frames will permit, should be ventilated in summer. I know of a number of switchboard rooms that are intolerably hot during the warm months. In addition to this, charging plugs should be suspended in such a way that when dropped they will not strike the floor. Local conditions must decide whether, if several floors contain vehicles to be charged, one switchboard shall control them all, or whether each floor shall have a separate one.

Ventilation should also be well looked to in the battery repair room, for here batteries are often gassing for a day or more on their initial charge. The floor of this room demands special attention, acid proof brick or tiles laid in pitch being the best construction. It is of the utmost importance that the drainage system from this department—the entire distance to the sewer—should be either of lead or glazed earthenware, and preferably run as "open plumbing"—not buried in the walls.

A small machine tool equipment is a very useful adjunct in an electric garage, even where most of the work is sent out. A lathe, drill press and emery wheel will do most of the odd jobs that come up from day to day. A more complete equipment would include a shaper, milling machine and power hack saw. If the garage is to be capable of handling everything that may become necessary, it should include well equipped carpenter and paint shops. There is much to be said in favor of this, since then a car need never leave the garage except for its daily work.

Now as to management: In the first place, let there be one head to the entire system. If it is possible (and it ought to be nowadays) to combine in one person business ability and a thorough technical knowledge of the industry, then this is the desideratum. If not, then let the head be by choice a good business man, with a broad enough mind to know his limitations in other fields, and to trust his well chosen technical subordinates. Many failures in management have resulted from trouble between executives vested with co-ordinate powers; or again where large stockholders with no qualifications have held office.

From the head, direct lines of responsibility should radiate down to the most unimportant employee, so that each one shall know the scope of his work and its relation to the next move in the daily cycle of events.

There are a number of important questions that come up for decision almost daily in the operation of a garage. For instance, shall the customer be billed for accidents which may have been preventable? A chain comes off because a strut rod loosened. A controller finger burns or freezes (as the case may be) because the contact was rough. A chauffeur is arrested and fined for having no tail light—the bulb being burned out. You will note in all these cases that there is room for argument, since it is possible to say that a perfect inspection system would not have allowed the accident to occur. There are some garage managers, I am afraid, who regard such accidents as those just mentioned in the light of "Acts of Providence," especially provided to furnish them a source of revenue. In general it may be said that a public garage cannot afford to have as many really preventable accidents as a private garage can. That is, a public garage will suffer in its standing among others, and get a bad reputation if too many accidents happen. A customer whose single car is unwarrantably laid up for half a day will naturally make no end of a row about it, for, aside from the extra expense, all his plans for the day's work are upset. Perhaps I can state the case more tersely by saying that breakdowns in the case of a private garage, may, up to a certain limit, cost less than the inspection necessary to prevent them, whereas in a public garage very few strictly preventable accidents can occur without unfavorable comment and possible loss of business. This is not intended to justify preventable mishaps in either case, it is only a comparison of results. In point of fact, it takes only a very few accidents to equal the cost of a system adequate to prevent them.

At present rates charged for garaging the small cars are the ones that pay the dividends. This is not because the rates are so far from equable, but because the small car on the average does not carry so large a proportion of its possible load as does the large one. A five-ton truck is chosen and purchased for certain work because that—and often a great deal more—is the load to be transported. But the light car is bought, perhaps, to replace a horse and wagon doing odd jobs, or with the idea of being up-to-date, or again with an eye to some advertising advantage.

In dealing with the owners of commercial cars, as a rule it is only the recent purchaser who is unreasonable and not will-

ing to meet the garage management half way in the matter of disputes on bills or service rendered. A recent case is reported of a new car that ran to perfection for two weeks while operated by the factory demonstrator, and after he left was in constant trouble. The owner complained bitterly that his car was not being charged, and it was with great difficulty that he was finally convinced that the new driver was running the car with his brake set.

Another question is, just what repairs shall be included in the flat monthly rate. Minor adjustments are conceded without extra charge, but there are a number of repairs that become necessary from time to time that hardly come under this head. An owner asks to have his smashed tail light straightened out, or new licenses put on, or perhaps says, "Just lend me a bell, or a spring, or an armature (as the case may be) until mine is repaired." The "just" indicating that he does not expect to be charged for the service. Sometimes it is hard to decide just how far generosity can be stretched, but as a rule I may say that it all depends on the customer's record. Of course, old cars require a lot more in the way of incidental repairs than those of recent years, and to do any free work on them that should be charged encourages the owners in keeping them going. If I am creditably informed, there is at least one manufacturer of electric commercial cars who always scraps an old car of his own make when taken in trade, instead of giving it a coat of paint and selling it again. This policy is much to be commended, since it rids the electric vehicle world of an undesirable citizen, and raises the average efficiency of the cars that are running.

ELECTRICS IN NEW ENGLAND.

Large Increase of Registration of Vehicles During the Past 12 Months.

According to figures compiled by Business Secretary O. G. Draper of the New England section of the Electric Vehicle Association of America there has been a very large increase in number of electric vehicles registered in the different states during the year ending June 14, 1913. These include those used for pleasure and for business, and the total is well in excess of 1000. The statistics show the following:

	Passenger	Freight	Total
Connecticut	220	30	250
Maine	3	3	6
Massachusetts	497	363	860
New Hampshire	15	2	17
Rhode Island	15	8	23
Vermont	3	2	5
Totals	753	408	1161

Analyzing these figures it will be noted that Massachusetts has 74.07 per cent. of the total, Connecticut 21.53 per cent., Rhode Island 1.98 per cent., New Hampshire 1.46 per cent., and Maine and Vermont the remaining .96 per cent. Taking the passenger vehicles Massachusetts has 66 per cent., Connecticut 29.21 per cent., Rhode Island 1.99 per cent., New Hampshire 1.99 per cent., and Maine and Vermont the remaining .81 per cent. Of the freight wagons Massachusetts has 88.99 per cent., Connecticut 7.35 per cent., Rhode Island 1.97 per cent., and Maine, New Hampshire and Vermont the remaining 1.69 per cent.

The reason for the large ratio of both passenger and freight machines in Massachusetts is due to there being branches and agencies at Boston of a number of leading makes, and there is much less complete representation in the other cities of this section of the country. There is a much greater number of charging stations, the cost of current is comparatively low, and the work of the representatives has been very generally in the localities in which they are stationed. It is not too much to state that the number of branches and agencies in Boston is more than in the entire territory outside of that city. There is, moreover, more than half the population of New England in Massachusetts, and close to 60 per cent. of the population of the six states is within a radius of 60 miles from Boston.

It is a fact that the use of electric vehicles is confined to localities, generally the cities and towns in which there are charging facilities and the rates for current are reasonable. This is especially true of Hartford, where there are two exclusive electric garages, one for passenger cars and the other for wagons, and the Hartford Electric Light Company is agent for several makes of vehicle and has systematically promoted their use. This condition is true to a lesser degree in other communities, in a number of which within a comparatively short time systematic promotion has been begun, which is already producing results.

The best demonstration of the increase of electric machines is shown by the following registration figures, which are of June 14 of the present year and 1912 and are taken from the Massachusetts state records:

	1913	1912	Gain	Per Cent. Gain
Passenger	497	370	127	34.3
Freight	363	183	180	98.3
Total	860	553	307	53.7

From these figures it will be seen that the gain in passenger cars has been very large, but the increase in freight wagons has been approximately 100 per cent. This ratio is extremely interesting, for it is more than keeping pace with the gain made by any other type of motor vehicle. Last year, to Nov. 30, approximately 4000 motor wagons of all kinds were registered in Massachusetts, and of this total about 4.5 per cent. were electric. Thus far on the basis of the number of electric vehicles registered there ought to be approximately double the number of gasoline wagons to maintain the percentage of last season.

In considering the registration it should be stated that there are a number of installations of good proportions that have been planned, but the machines have not been delivered, and without much doubt at the conclusion of the official year of the Massachusetts highway commission there will be found a percentage of increase that will at least be the equal of that shown to the date named. The gain has been especially noticeable with reference to freight vehicles, and the reference made to gain has been entirely applied to this type. In the eastern part of Massachusetts, east of Worcester and including Worcester county, there are now approximately 400 passenger cars and 250 freight vehicles, a total of 650.

Two large motor 'buses capable of seating 20 persons, have been put in service at Excelsior, Mo., by Harry Silver and O. G. Pile, owners of the Day and Night garage. The machines are operated between the railroad station and the hotels and are available for picnic and outing parties. The 'buses are built on the chassis of Velie trucks, made by the Velie Motor Vehicle Company, Moline, Ill., the bodies being built by the Hess Carriage Company, Kansas City, Mo., and are giving good service.

ELECTRIC EXPRESS HAULAGE.

Development of Enormous Business Illustrated in a Motor Truck Parade.

In the recent Newark, N. J., truck parade there was a novel illustration of the development of the express business, which was originated by T. J. Hawkins, manager of the branch of the Adams Express Company in that city. This consisted at the start cf the parade of four units, the first being a man carrying a carpet bag of mammoth proportions, a replica of that with which Alvin Adams began to travel as a messenger between Providence and New York in 1840. Adams travelled by train and by steamer and carried parcels for persons who at that time desired special and quick delivery and were willing to pay for the service. The business quickly extended until it served Boston, Worcester and numerous New England cities, and when the carpet bags were no longer adequate push carts were used to collect and deliver the parcels. Later on horses and wagons were used, and these served until the development of the motor vehicle impelled the utilization of a large number of these machines by express companies.

Exhibit Made in Newark, N. J., Motor Truck Parade, Showing the Development of Express Transportation from the Carpet Bag to the Electric Wagon.

When the procession was formed the exhibition, which was intended to show the superiority of the present day equipment, was placed at the head, but before the first block of the route had been traversed the executives realized that the maximum speed of the men carrying the carpet bag and pushing the cart was so slow that the parade would be greatly delayed, so the men and their exhibits were placed in the horse wagon and carried, but it was later necessary to withdraw the animal vehicle so that the machines could move at normal pace.

Relative to the use of motor vehicles by the Adams company the first experiment was made in Jersey City about 15 years ago with several large trucks propelled by steam, but these were not found satisfactory. The first permanent installation of motor wagons was made by the company with its advent into Buffalo and Rochester, N. Y., in 1903, and since that time the use of machines has increased, there being now about 500 in the service of the company. The first order for Lansden wagons was for 25, and the second order was for 25 more for use in Philadelphia. Lansden electrics are used exclusively in Newark, the experience being that the company can do its work with fewer vehicles, though the business has been increased and the radius of operation broadened. The Lansden machine was selected because of its ease of handling, an essential factor where frequent stops and starts are necessary, and its simplicity such that the company could retain its old and experienced drivers, who were familiar with the work and the routes. The company maintains its service station and charging plant, and from carefully kept records has realized that the operating expense and upkeep cost has been considerably reduced.

The company has not been able to whittle off miles nor lengthen hours of labor and the problem has been, and no doubt always will be, how to conquer time and distance and get more work within the same number of hours. As communities expand and delivery distances become greater the company is compelled to take care of this increase without adding to the cost, as the limit of express charges has become fixed by common usage. The only way that delivery charges can move is downward, and the only manner of maintaining patronage has been by keeping abreast of requirements by the public. The use of the motor truck has been the means of meeting these new demands.

So satisfactory have been the results where installations have been made that the company's policy may now be said to place motorized equipment as needs are developed in communities of considerable size and importance.

The Luverne Automobile Manufacturing Company, Luverne, Minn., is building commercially a unit power plant that consists of a four-cylinder motor, dry multiple plate clutch, selective type sliding gear transmission gearset, fitted with carburetor, high-tension magneto and the control pedals and levers attached. These are also fitted with electric starter and generator for lighting. The plants are sold ready for installation in any type of motor vehicle.

The Cleveland Macadam Company, Cleveland, O., which operates a five-ton White dumping truck in the haulage of crushed stone, has figures that show that the truck earned $500 a month for a period of 4.5 months, when it was constantly in use, it being loaded by gravity and dumped by the power of the engine. There was a large measure of economy in quick loading and unloading.

Municipal Service Equipment

PALMER-SINGERS FOR NEWARK.

Three Brighton Six-Cylinder Roadsters for Fire Department Chiefs.

An accompanying illustration shows three Palmer-Singer Brighton six-cylinder roadsters recently furnished by the Palmer & Singer Manufacturing Company, Long Island City, N. Y., for the chiefs of the fire department in Newark, N. J. The chassis are the standard Brighton model, the principal specifications of which are: Motor, six-cylinder; bore, four inches; stroke, five inches; horsepower, 45; transmission, selective, three forward speeds and reverse; rear axle, full floating; front axle, I beam; wheels, 36 inches; spokes, 2.125 inches; tires, four inches; wheelbase, 127 inches; tread, 56 inches; gasoline capacity, 21 gallons.

One of the cars is fitted with a rumble seat, the gasoline tank being under pressure below the frame. The others have tanks above the frame, the supply being by gravity, although pressure may be used. All are equipped with electric horns, with two push buttons, one on the right of the driver's seat and the other in the floorboard, in front of the left seat.

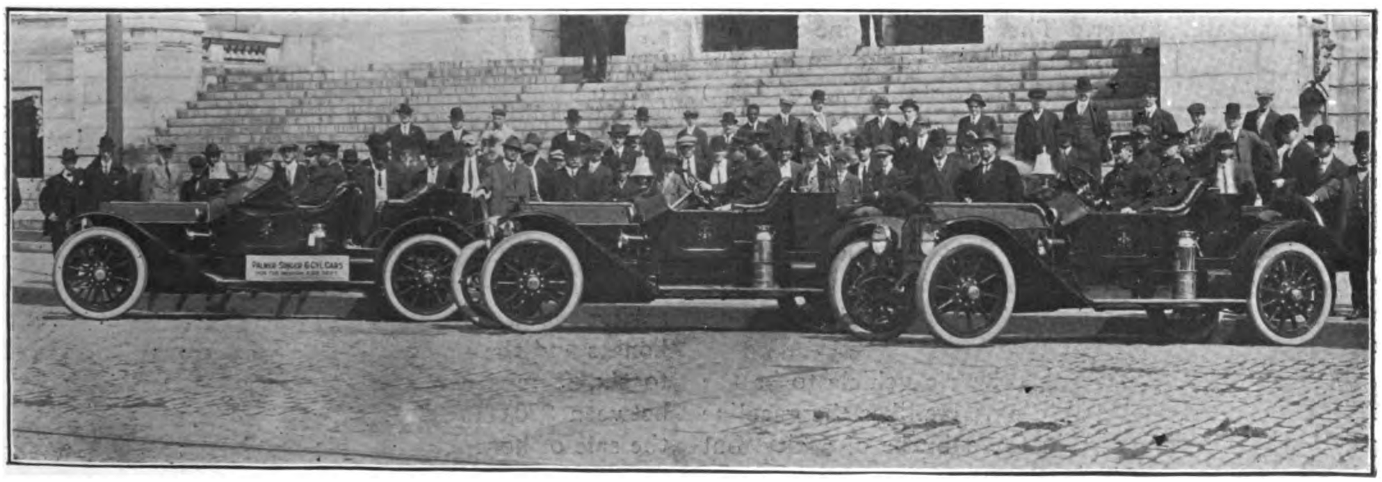
An extinguisher is carried on the left running board. A large box is securely mounted back of the front seats for boots, helmets, coats, etc. Tires are carried at the rear, Firestone demountable rims with one spare being standard equipment. An air starter is used in connection with a four-cylinder pump, clutch driven, a connection being supplied for inflating tires, cleaning motor, upholstery, etc. The lighting system is electric, the side lights having red glass and the head and tail lamps being standard. The regulation bell is securely mounted on the cowl.

SUPERIORITY OVER HORSES.

Figures of Department in Springfield, Mass., Show Economy of Motor Fire Apparatus.

No more convincing proof of the superiority of motor driven fire apparatus over horse drawn types can be cited, both with respect to efficiency in preventing fire losses as well as in the actual saving of departmental expenses, than the recent report submitted by the chief and fire commissioners of Springfield, Mass. There are now 22 pieces of motor driven apparatus in the service of the department, 80 per cent. of which are of Knox manufacture and a very interesting comparison is shown by reference to the report of five years previous, when the city had only three motor driven machines, consisting of a combination hose and chemical and two chief's cars.

The number of alarms answered by the department in 1907 was 498, with a property loss of over $535,000, while in 1912, 829 alarms were responded to, with a total loss of $166,000. It is plainly evident that the increase of motor apparatus in recent years has enabled the department to take care of a much greater number of fires with far less property loss than would have been possible with the old horse-drawn equipment.



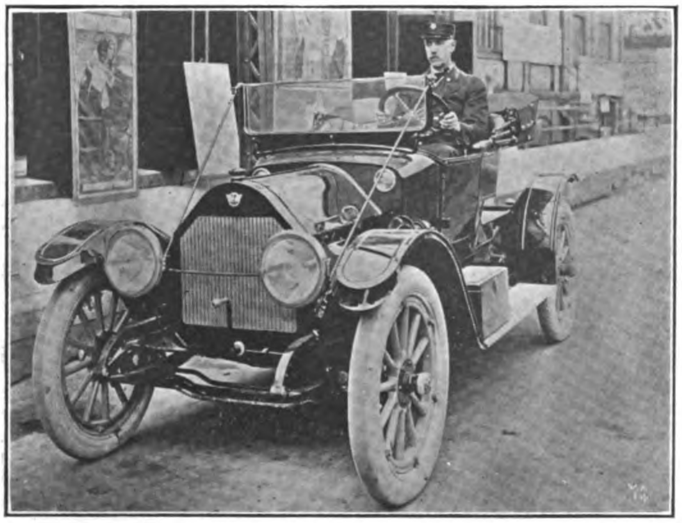
Three Palmer-Singer Brighton Six Roadsters Recently Installed with Fire Department, Newark, N. J., for Use of District Chiefs.

Further important facts are revealed as regards the saving in upkeep cost by comparing the reports of 1911 and 1912. The total expenditure for the latter year amounted to a little over $239,000, and included in addition to current running expenses were four large pieces of motor apparatus, new fire house and an increase of 32 men to the payroll. In spite of the unusual expenses and the added fact that 100 more alarms were responded to during this year than in 1911, a saving of nearly $8200 was made over the previous year's budget; surely a strong argument in favor of motor machinery from the standpoint of upkeep cost alone.

WANTS ELECTRIC TRACTORS.

Worcester Fire Chief Estimates They Would Save the City at Least $2000 Each.

Fire Chief Wesley N. Avery of Worcester, Mass., is in favor of electric motor tractors for at least three



Chief Haible of Elgin, Ill., in His Reo Roadster.

of the steam fire engines of that city and he believes that such a change would save the city approximately $6000 a year, or $2000 for each machine. The fire engines which Chief Avery would supersede with the tractors are three-horse vehicles and require a driver, engineman and stoker. The saving of one man on each machine resulting from the introduction of tractors would be $1100 for each, or a total saving of $3300 for that item alone. Estimating a cost of $300 for the maintenance of each horse, the elimination of nine horses would mean $2700, which added to $3300 would total $6000. Of course the maintenance of the motors would have to be taken into consideration, but with the saving to be gained in other ways than those mentioned to offset this, the total saving would be about $6000.

Chief Avery believes the electric vehicle to be the future machine for fire fighting. He likes the gasoline pumping engine for use in the suburbs of a city, but for the exacting work in the congested and business centres, he favors the old steam pumping engine equipped with a tractor. He maintains that the present machine does not take long to generate steam and that its dependability is a factor to be considered, while the gasoline pumping engine he claims is still far from the development it will probably later attain.

MOTOR TOWS STEAM ENGINE.

Practical Efficiency of Pope-Hartford Wagon Demonstrated at Norwich, Conn.

At a recent fire at Norwich, Conn., the Pope-Hartford combination chemical and hose wagon distinguished itself highly. The fire was on Orchard street, the highest point in that city of hills. The machine had no difficulty in climbing the hill with soft mud about six inches deep in some parts. After discharging the chemical tank it was found that a water line would have to be laid about 700 feet from the burning building.

The motor truck towed the steam fire engine, weighing 8500 pounds, a half mile to the hydrant and then made two more trips to headquarters a mile distant for hose and coke and six men. The machine climbed the hill three times with no trouble. Since it was installed a year ago it has answered 84 alarms, travelled 179 miles at a total cost of upkeep of $55.60.

DAYTON CONSIDERS AUTOMOBILES.

Safety Director Estimates That First Cost Can Be Saved in Short Time.

Safety Director A. May Dodds of Dayton, O., in response to a request from the city council, has submitted an estimate of the cost of equipping the fire department with motor driven appliances, fixing the cost at $118,450. He explained that the prices he gave in connection with the various machines were based upon what he believed to be a fair estimate of the average prices for high grade motor apparatus, but that these may be reduced slightly by competitive bidding. His figures follow:

Nine hose cars at $5250	$47,250
Two city service ladder trucks at $6000	12,000
Two 85-foot aerial trucks at $11,000	22,000
Six tractors for steam engines at $4500	27,000
One automobile for chief	3,000
Two automobiles for marshals at $1800	3,600
Two trucks for hydrant and telegraph department at $1800	3,600
Total	$118,450

Director Dodds points out that with the motor equipment the number of hose companies could be reduced from 16 to 12, which would give a larger number of men to each house than is now the case. A saving would be made in maintenance of the four houses and the number of steamers would be reduced to six, from seven. Mr. Dodds also estimates that between $20,000 and $25,000 could be obtained from the sale of horses and unnecessary equipment, and altogether, the total cost could be considerably reduced in numerous ways. In addition, the city would place

itself among the foremost cities in the country in the matter of fire fighting equipment and the cost of maintenance in a few years would pay for the total investment. It seems quite likely that the city council will decide to adopt Mr. Dodd's recommendation to completely motorize the Dayton fire department.

NEWS FROM VARIOUS CITIES.

Reo for Elgin Fire Chief—An accompanying illustration presents the 1913 Reo the Fifth roadster, made by the Reo Motor Car Company, Lansing, Mich., and used by Chief William Haible of the fire department in Elgin, Ill. Factors which determined the selection of this machine were the left side drive and centre control levers, making it possible to leave the car from either side without delay.

New Equipment in Fall River—A KisselKar double tank machine and a Pope-Hartford single tank car have been ordered by the fire commissioners of Fall River, Mass.

Des Moines to Motorize Department—Councilman Van Liew recently submitted a plan to the city council of Des Moines, Ia., for completely motorizing the fire department of the city, which provided for the purchase of nine combination hose and chemical trucks, four hook and ladder trucks, one tractor and three combination hose and pumping trucks, at a total cost of $102,464.

In the Market—The following cities are considering the purchase of motor fire apparatus: Oswego, N. Y.; Fort Dodge, Ia.; New Bedford, Mass.; Buffalo, N. Y.; Healdsburg, Cal.; Taunton, Mass.; Reading, Penn.; Lewiston, Mont.; Tropico, Cal.; Manchester, N. H.; Jacksonville, Fla.; Kansas City, Mo.; Lockport, N. Y.; Ironwood, Mich.; The Dalles, Ore.; Corning, N. Y.; Greenville, O.; Benson, Neb.; Springfield, Ill.

Springfield, Mo., Adds Five Pieces—Springfield, Mo., recently placed in service a gasoline pumping engine, two motor hose wagons and a chemical engine, made by the American-La France Fire Engine Company, Elmira, N. Y., and a combination hose and chemical wagon, manufactured by the Anderson Fire Equipment Company, Kansas City, Kan. Together with the new fire alarm system, Springfield is well fortified to guard against serious fires.

Pope-Hartford Tractor Orders—The city of Brockton, Mass., has signed a contract with the Pope Manufacturing Company, Hartford, Conn., maker of Pope-Hartford fire trucks, for three combination hose and chemical wagons and a four-wheel tractor to replace a triple-hitch of horses on the hook and ladder truck at central station. The combination machines cost $5500 each, while the tractor is $4900, making a total of $21,400 for the equipment.

Federal Replaces Five Horses—A 1.5-ton Federal truck, made by the Federal Motor Truck Company, Detroit, has recently been placed in the service of the meter division of the water department of St. Louis, Mo. The overhead design is of special interest in that the quick loading and unloading of half-ton meters can be accomplished by the driver alone. The truck covers a route of 15 to 30 miles a day in transferring the men from one job to another. To date the data show that a crew of six men, divided into pairs, do the work of five single-horse wagons with 10 men.

Montreal Divides Between Two Concerns—Montreal, Can., recently appropriated funds and awarded the contract for eight high powered automobiles for the use of the deputy fire chiefs of the city. The award of the contract was a very unusual one, as it was divided equally between two competing automobile companies, although the entire eight cars are to be used for practically the same purpose and meet substantially the same specifications. The Cadillac Motor Car Company, Detroit, was awarded the contract for four, while the other four were awarded to the Abbott Motor Company of Detroit. Both concerns have cars in the service in Montreal and have made preliminary tests to the satisfaction of the city officials.

To Supply All Departments—In the recent appropriation bill submitted to the city council of St. Louis, Mo., provision is made for the purchase of 19 automobiles for the use of various city officials. The cost of them will be $24,000, as follows: Street department, touring car for commissioner, $2400, and four runabouts, $2400; commissioner of supplies, automobile, $1500; city lighting department, three runabouts, $1800; fire department, automobile supply truck, $3000; fire and police telegraph automobile, $2500; sanitary division, health department, two runabouts, $1100; city forester, runabout, $1000; hospital department, city dispensary, two automobile ambulances, $6000; industrial school, automobile, $1000; assessor and collector of water taxes, two runabouts, $1200.

Chelsea Secures Powerful Engine—Chelsea, Mass., which five years ago was nearly wiped out by a conflagration, has put in service what is claimed at present to be the most powerful fire engine in the world. It is known as a triple combination gasoline pumping engine and cost $10,000. The machine is capable of travelling at a mile a minute, throwing four streams of water, twice the number of the ordinary fire engine, and pumping 1200 gallons of water a minute, equal to two steam engines. In addition it is a chemical engine and hose cart, carrying 1200 feet of hose, and is equipped with two 25-foot ladders. In other words, with its crew of five picked men, it is a modern fire department all by itself. The tests of the machine demonstrated its capabilities to answer to all claims made by the maker, the Robinson Fire Apparatus Company, St. Louis, Mo.

MACK TRUCK IN HEAVY WORK.

Maintenance Figures Supplied by Structural Iron and Steel Contractor in Philadelphia.

The transportation of structural iron and steel is a heavy duty service which imposes very hard usage on any kind of vehicle and causes exceptional strains on the entire chassis. The five-ton Mack truck, made by the International Motor Company, New York City, in the service of the H. T. Potts Company of Philadelphia, has given excellent satisfaction in this field.

The Potts company is contractor in structural iron and steel material which is delivered to the builders throughout Pennsylvania and New Jersey. The average daily performance of 26 miles indicates the general conditions under which the loads are transported. H. T. Potts, superintendent of transportation of the company, has kept a carefully compiled record of the Mack truck since Aug. 14, 1911, to March 31, 1913. In that time the total disbursements for all purposes were $1985.37. This figure includes every expense—driver's wages, insurance, etc.—with the exception of depreciation and interest.

The total tire cost in the above period was $765.94, but an expense of $115.25 was incurred when the vehicle was painted and alterations were made. Included in the outlay was $85.36 for a speed and mileage recorder. Pennsylvania and New Jersey licenses for the vehicle and driver amounted to $123, $41 a year. Eliminating these items from the gross expenses, the maintenance cost amounts to $985.87. The tire expense, adding the value of the original tires, the item noted above, works out at .0096 a mile.

During this period the working days for the truck numbered 407; total mileage, 12,220; cost a mile for tires, including tires supplied with truck, 9.56 cents; operating costs a day less the tires and driver, $7.30. This includes gasoline, repairs, supplies, oils and greases, renewal of parts, etc. In all the 407 working days the truck was actually out of commission only six days, not including the time it was voluntarily laid up for painting.

The Watson Contracting Company, New York City, specializes in street grading and naturally the one big item of expense is the cost of hauling heavy building materials from the water front to the location of the different jobs. Previous to 1912 the company used horses exclusively for all its hauling. As an experiment it purchased two Garford trucks, made by the Garford Company, Elyria, O., and kept a careful check on the amount of work they could do, together with upkeep costs as compared to that of horses. The economy and all around efficiency was so apparent that today the concern has in operation a fleet of 18 Garford machines. Mr. Baisley, a member of the firm, claims that one of these will do the work of at least nine of its best horses and that as many as 44 horses have been sold at one time since the Garford machines were installed.

WILCOX SAVES THE BUSINESS.

Transfer Man Enabled to Make a Profit After Failure with Horse Drawn Equipment.

A lesson in the value of the motor truck might be learned from the experience of Charles Martin of Germantown, Penn. He went into the transfer business five years ago on a fairly ambitious scale, with seven horses, three wagons and three drivers. The average price of his horses was $150. Business came quickly and there were prospects of good profits when his horses began to fail. His Germantown run was long and hilly and the journey consumed so much time that the horses had to be fed en route, with the result that they developed colic and indigestion. Eleven horses died in 10 months. Five more went in the second year, making a total loss of $2400, for the prohibitive rate on horses had put adequate insurance out of the question.

Martin faced ruin, having lost his entire investment. He was about to seek another means of livelihood when it occurred to him to purchase a motor truck. This was a daring project, for $3000 looked big to him at that time. But his logic was sound. He had the business and all he needed was a medium of delivery. If he could eliminate the horse and secure something that would not sicken and die, he could operate at a profit.

He purchased a 1.5-ton Wilcox, made by the H. E. Wilcox Motor Car Company, Minneapolis, Minn., and it replaced seven horses and three drivers, for it was found to be able to do all the work of collecting from the manufacturers in Germantown and vicinity, articles to be taken into the centre of the city and the wharves for shipment by various steamship lines. On the return trip supplies are distributed to drug stores. These goods are the products of wholesalers in the centre of the city. Martin did all his own driving in order to aid his policy of retrenchment. The truck moved so quickly that it covered the whole route and by 8 in the evening was back in the garage ready for any profitable night work which offered. At reasonable rates he was able to carry four kinds of insurance —property damage, liability, fire and collision. This eliminated any risk. That was a year ago. In the interval the truck has paid for itself and declared a substantial profit for its owner.

A one-ton Kelly, made by the Kelly-Springfield Motor Truck Company, Springfield, O., is saving $50 a week for the Coca Cola Bottling Company, Rome, Ga., according to F. S. Birem, manager of the company. This saving is made in livery and hotel bills. Before the purchase of the truck some of the hauls by wagon took two days, and it was necessary to pay hotel and livery bills two or three nights a week for two teams and two drivers. The Kelly makes these hauls in less than a day, averaging from 75 to 100 miles a day for six days.

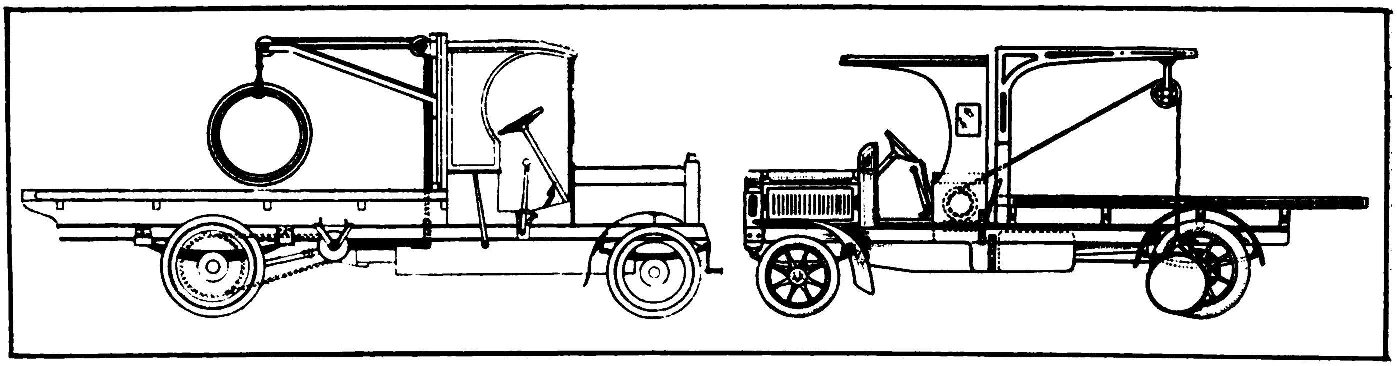
FOREIGN TRUCK NOTES OF INTEREST

CONCERNING LOADING DEVICES.

Some Suggestions That Make Their Appeal to British Motor Truck Users.

Attention has been drawn a number of times recently to the discussion of quick loading and unloading devices which is now occupying the minds of British motor truck users. This is brought out very forcibly in a recent number of The Commercial Motor of Great Britain, which states that it has been confronted of late by a large number of inquiries concerning power driven loading devices from users whose loads consist of casks or similar bulks.

An accompanying sketch presents two such arrangements fitted by British manufacturers. That adopted by the maker of the Karrier wagon has the winding drums placed at the side of the chassis frame members in such position as to allow the hauling ropes to be taken either to a jib arrangement mounted over the platform, or by way of leads to lower barrels of beer, etc., into a cellar or to hoist them onto a loading platform. It is intimated that the actual arrangement of the gearing is a question for the designer, and it is held that this involves no question of serious moment.



Suggested Easy Loading Devices for British Brewery Truck Users: At Left, Power Hoisting Arrangement on Leyland Vehicles; at Right, Patented Hoisting Gear on Karrier Wagons.

The plan adopted by the Leyland Company is a variation of the Karrier patented device and is even more fully set forth in the drawing. This company also has a small jib crane fixed on the platform and provided with a swivel accommodating an ordinary pulley block, the drums in this case being designed to be operated by hand.

MOTOR TRUCKS IN BRAZIL.

Consul-General Lay Gives Advice Respecting the Correct Procedure in This Market.

According to Consul-General Julius G. Lay of Rio de Janeiro, Brazil, more American automobiles, and particularly motor trucks, would be sold in that country if manufacturers would establish agencies where spare parts and cars could be kept in stock. An American using trucks informed Consul Lay that he did not buy his machines in the United States, although they were better suited to his purpose and more reasonable in price, because he could not wait for parts from this country, and he therefore purchased a German truck, sold by an agent carrying a full line of spare equipment.

There is an increasing demand in Rio de Janeiro, which has a population of nearly 1,000,000, and in other large ports of Brazil for American trucks. The streets of Rio de Janeiro are paved with asphalt for many miles, the distances are great and the traffic heavy. Mr. Lay believes that American motor vehicle manufacturers cannot expect to secure even a small share of this trade by arranging agency contracts through correspondence and advertising their goods by catalogues. The only way, in his opinion, to establish satisfactory connections and secure a firm footing in that market is to send there a competent representative with one or two sample cars, prepared to remain several months to assist his agent in demonstrating and advertising the machines.

GERMANY'S MOTOR CREMATORIES.

Automobile Equipment to Be Used in the Future in Disposing of Battle's Dead.

After thousands of years of being buried with honors on the field of battle, soldiers in the future will be incinerated in portable crematories mounted on motor trucks. At least this is the plan of the German general staff, following the report submitted to it by an army surgeon who accompanied the Bulgarian army and who witnessed the various assaults on Adrianople.

He reported that had it not been for the cold weather, which prevented the bodies from decaying on the battlefield, the vapors arising from them would

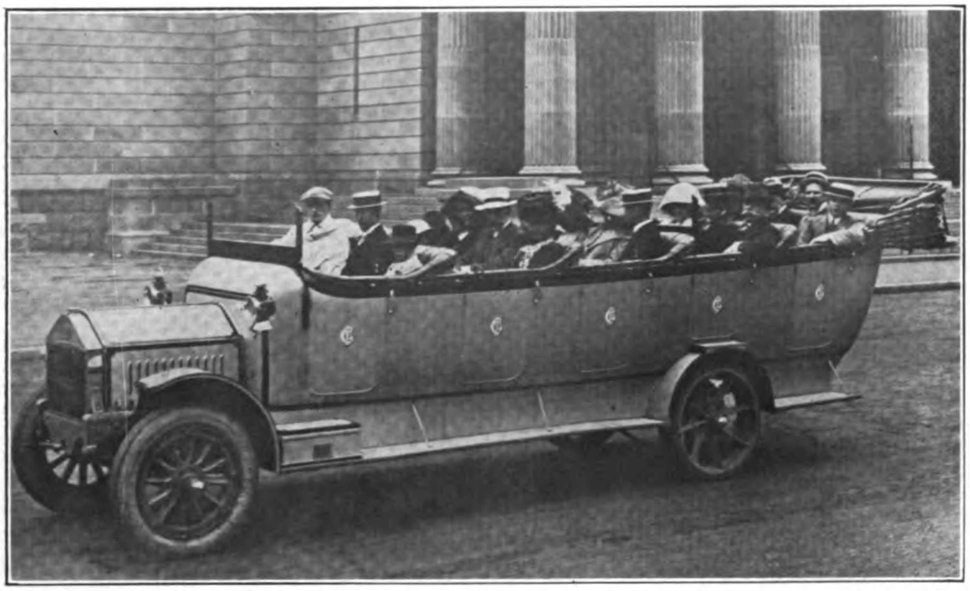
have caused disease, with untold results among the survivors. In the future this contingency will be met by the use of motor crematories, capable of incinerating at one operation from 10 to 25 bodies and able in the entire 24 hours of each day to dispose of from 300 to 500.

AGAIN THE CHAR-A-BANC.

British Engineers Enthusiastic Over Its Possibilities in This Country.

Among the suggestions offered by the party of British engineers during the recent American tour was that of the possibilities of the char-a-banc in this country. Several of the visitors were very enthusiastic with respect to the matter.

An accompanying illustration shows a Lacre char-a-banc of the so-called torpedo type, designed to accommodate 20 passengers. These vehicles are used in



Thirty Horsepower, 20 Passenger Char-A-Banc of the Torpedo Type, Manufactured by the Lacre Motor Car Company.

Great Britain in many of the country towns and the suburbs of cities under conditions where it would be expected that short trolley lines would be operated in this country. In England they have been found a decidedly paying proposition, as may be gained from the knowledge that the cars are splendidly upholstered and the appointments are much more elaborate than the so-called motor 'buses sometimes utilized in America.

The chief advantage claimed for the vehicles, in catering to the convenience of the public, is that they draw up to the curb to take on and deposit a fare, thereby obviating the necessity for the passenger to cross a portion of the roadway, as with the trolley service. In both England and France, where these cars are operated in large numbers, it has been found that the public is very liberal in its patronage, char-a-bancs being hailed for a short trip of half a dozen blocks instead of the patron attempting to walk the distance.

The opinion expressed by the visiting engineers was that within a few years many of these vehicles would be in operation in America and that they would be found to present a business proposition in every way as successful as they now are abroad.

PERUVIANS TESTING TRACTOR.

Government Officials and Prominent Citizens Interested in Demonstration of American Product.

Recently a demonstration of an American traction engine was made in the suburbs of Lima, Peru. A special train was run to the field at the expense of the local manager, Fernando Ortiz de Zevallos. About 100 of the most prominent owners of estates in Peru were present, also the minister of public works and development, director of irrigation and agriculture and other officials of the government, as well as the principal officers of the American legation in Lima and the consulate at Callao.

The object of the demonstration was to place on record the facts relative to the possibilities of traction engines in Peru for cultivation methods. The exhibition lasted the entire day and the spectators seemed well pleased with the deep plowing possibilities and the complete success of the machine in turning over the surface of an old field formerly planted in cane and still covered with roots, which hitherto always had to be burned out. Although there have been several British and other foreign machines imported to Peru, this is the first American tractor of its kind that is known to have been used in the South American republic.

AUSTRIAN WAR VEHICLES.

Government Is Now in the Market for 200 Machines with Full Military Equipment.

Austria, through its war office, recently placed orders with the four local automobile factories at Prague for 25 to 30 trucks and trailers, each truck having a capacity of 10 tons, the price paid for each machine and trailer being $5380. The same trucks are sold to firms or individuals for $3350, and when thus sold to private purchasers the government pays the factory a subsidy of $2030 for each truck. The government keeps a record of all these vehicles and in the event of war they are taken at an appraised valuation. They must also be placed at the disposal of the government for 14 days each year, during military practise, for

which service the owner is to receive $8.12 a day.

The government is also in the market for trucks of the second class, or light vehicles, up to 200 in number. They must be capable of carrying from 2,000 pounds to two tons at a speed equal to that of the heavier cars. Both classes must be able to ascend a gradient of one in 10 on bad roads. The specifications are furnished with each class. The second schedule calls for searchlight trains up to 50 sets. Each is to consist of a light motor chassis with a 25 to 40 horsepower engine, and a 10 to 15 kilowatt dynamo for the searchlight; a trailer with one searchlight of 90 millimeters or more fixed on the car, or with two portable searchlights or about 60 millimeters, with a cable drum and 200 or 300 yards of cable.

HIGHWAY CONSTRUCTION IN CHINA.

Native Engineers Engaged in Laying Out New Road for Motor Truck Service.

Chinese engineers, under the direction of Jick G. Wong, an American trained engineer, have been at Hong Kong, China, making arrangements for commencing the survey of an automobile truck road in Kwangtung province, which is designated as a feeder for the Kwangtung section of the Canton-Hankow railroad. The road now planned and for which detailed surveys are being made, will be about 100 miles long.

It is expected to start at a station called Po-Ko, about 70 miles from Canton, and will follow the line of the old imperial mail and courier road or path, a way over which imperial dispatches have been transported for hundreds of years by relays much in the manner of the old pony express in the West of the United States. It is planned to give the new road considerable hard surface dressing and to build substantial bridges. No decision has been given yet as to motor trucks to be used. The company behind the project is composed of Chinese capitalists.

EASTBOURNE'S MOTOR OMNIBUSES.

Official Report Shows Department Is Being Placed on Satisfactory Efficiency Basis.

The annual report of the Motor Omnibus department at Eastbourne, England, is of considerable interest, inasmuch as Eastbourne originated 10 years ago the municipal carrying of passengers by motor 'buses. P. Ellison, general manager and chief engineer of the company, reports that for the year ending March 31, 1913, the department showed a net profit of over $3500, which is the highest net earning recorded during the life of the undertaking. The gross profit for the year was about $18,500, but of this about $15,000 was paid out for interest and repayment of loans.

In spite of the excellent showing, it is brought out that owing to weather conditions the number of passengers carried decreased some 30,000 over the previous year, requiring a smaller number of vehicles, this reducing the total mileage for the year by 6740 miles. The number of passengers carried a mile, however, increased from 11.12 to 11.32, while the cost of operation remain stationary. The figures for repairs and maintenance show a marked decrease over the preceding year. That the operation of the various motor lines is to be placed upon a better basis of efficiency is apparent.

GENERAL NEWS FROM ABROAD.

Great Britain Buys Military Trucks—As a result of the recent qualifying trials, the British war office has purchased 15 three-ton trucks of John I. Thorneycroft, Ltd.

Hungarian Plowing Competition—An international competition of motor plows is to be held at Galanta, Hungary, in July and August, under the direction of the Hungarian Agricultural Society of Budapest.

Wants Agrimotor Agency—A representative of a large and well established concern in Australia was in England recently to secure the agency for agricultural motors in that section. It is stated that the possibilities for this class of vehicles are decidedly good.

Russian Mail Service—A motor mail and passenger service has been organized in Siberia, Russia, on the route from Verkneaudinsk and Troitskosavsk, in the province of Transdaikale. The length of the route is 215 versts and the service runs once a day in either direction, the fare charged being between 21 and 22 roubles a passenger.

British Imperial Conference—A large number of delegates representing the varied business interests in the various colonies and dependencies of the British empire will be present at the imperial motor transport conference to open July 18. From even remote places delegates are assigned and the coming conference promises to be of great importance and a wonderful stimulus to the motor truck industry.

Testing Kerosene Carburetor—Under the open competition rules of the Royal Automobile Club, England, a road test of 1000 miles was recently made with a 20 horsepower Ford car, fitted with a Standard kerosene carburetor. The trial was made on the club's six standard routes and the distance was covered at an average speed of 19.91 miles an hour. On 10 occasions after short stops the engine was started on kerosene; at other times the gasoline carburetor was used for starting. The amount of kerosene used was 30.28 gallons, representing a consumption of 33.03 miles a gallon, or 35.69 ton-miles a gallon. For starting purposes 1.69 gallons of gasoline were used.

New Commercial Car Accessories

Eiker Carburetor.

One of the features of the Eiker carburetor, manufactured by the Eiker Carburetor Company, 1790 Broadway, New York City, is that the spray nozzle is located in the middle of the throttle disc and a tapered adjustable needle valve moves backward and forward, automatically increasing or decreasing the supply of fuel with the opening and closing, respectively, of the throttle. The maker holds that this construction eliminates the necessity of a venturi tube or extra jets. It has but one air inlet. It is pointed out that water or sediment in the fuel cannot clog the spraying nozzle as the feed pipe is well below the level of the gasoline. The base, which includes the auxiliary a'r valve, air intake and hot air connection, adapts itself to four different positions, making for convenience in installation. There are but two adjustments, the fuel and the air. Easy starting, economy of fuel and flexibility are emphasized with the Eiker.

Apco Master Vibrator.

The Auto Parts Company, Providence, R. I., is marketing a new master vibrator for model T Ford cars termed the No. 3. The new coil is but 1.5 inches thick, 3.5 wide and five high—dimensions permitting of installation under the hood if desired. The case is of mahogany, nicely finished, and the removable cover is accurately fitted, excluding dirt, etc. All exterior components, such as parts, terminals, etc., are heavily nickel plated. The adjusting screw of the vibrator includes a special locking device, and the contact points are unusually large, insuring long life with minimum care. Particular attention has been paid to the windings and these are designed to withstand high voltages. Although the Apco vibrator is moderately priced the best of workmanship and material are incorporated.

Regent Breast Drill-Valve Grinder.

P. G. H. Bennett & Co., Lansdowne street, Fenway, Boston, is marketing the Regent breast drill and valve grinder, a combination tool. It is furnished with a Star expansion chuck taking drills up to .25 inch, a screw driver blade for slotted valve heads and screws, four spanner tools to fit different makes of cars, and a coil spring. The last named is fitted under the valve when grinding. One of the features of the tool is that it may be changed easily and quickly from a breast drill to a valve grinder or vice versa, by a simple movement of the index finger. This is accomplished by actuating a shifting finger or trigger. By utilizing this member when grinding valves the motion can be changed instantly to a reciprocating one of about 45 degrees. The best of material and workmanship are incorporated in the tool.

Invincible Blow-Out Patch.

The Invincible blow-out patch, made by the Invincible Tire Company, 53 Sabin street, Providence, R. I., maker of the Invincible tire, differs from the usual patches in that in addition to the conventional fabric there are two layers of chrome leather. These are inserted between the layers of fabric, and being very pliable conform readily to the shape of the casing when inserted. This construction makes the patch puncture proof. One side of the outer fabric is coated with pure para gum, protected from dirt, etc., by a holland cover. When use of the patch is desired the cover is stripped and the gum surface moistened with gasoline. This side is applied to the interior of the casing and being self-vulcanizing it is impossible for the patch to creep or slip. With the Invincible the use of an outside sleeve is not necessary as the chrome leather reinforces the construction. It can be utilized over and over again.

McNutt Automatic Closing Can.

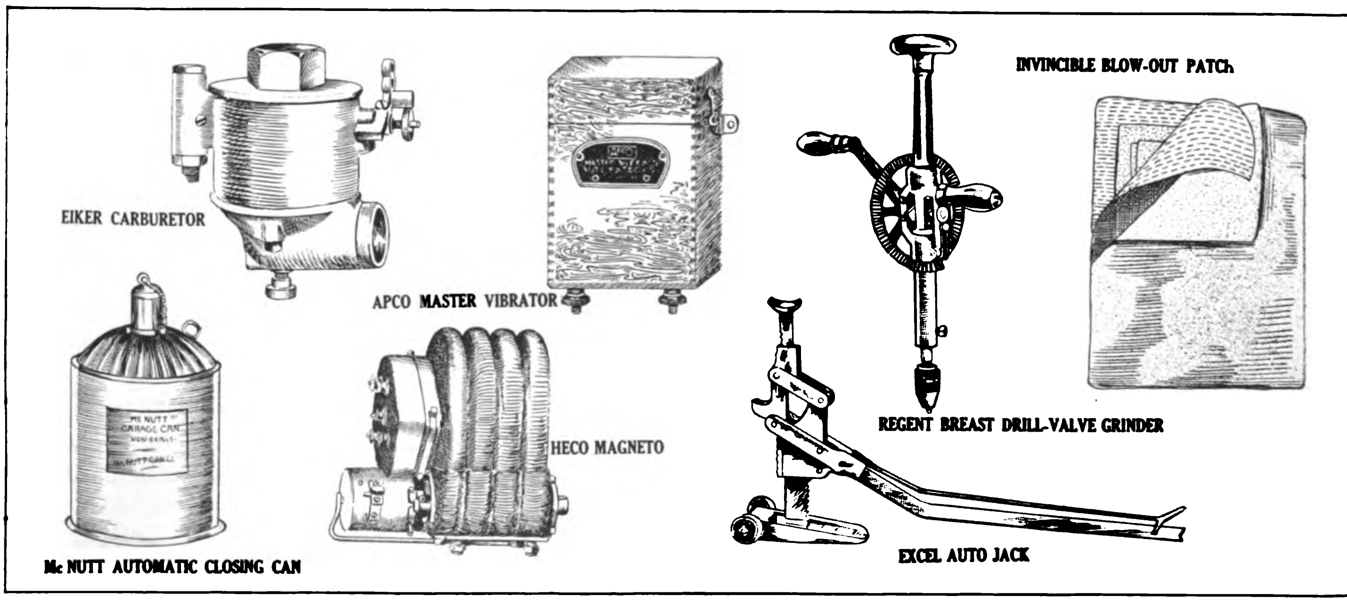
The McNutt Non-Explosive Can Company, 352 Pearl street, New York City, is manufacturing the McNutt automatic closing can, which is produced in five and 10-gallon types. They are equipped with the McNutt safety device, which is also utilized in fuel tanks of all dimensions and which has been indorsed by the fire department of New York City. The device sounds a warning, as soon as a dangerous pressure occurs, by making a loud whistling noise, and a safety valve releases the pressure. The screw cap is provided with a fusible disc valve, which, when the container is subjected to contact with fire, will give vent to the pressure, thus preventing explosion. The valve seat will melt at 300 degrees Fahrenheit, and the entire valve will blow out, leaving a clear opening and preventing bursting of the container. Further protection is afforded by a fire screen located at the bottom of the device, it preventing the flame back-drafting into the tank. The safety screw cap is provided with a check valve for gravity systems, preventing vapors from leaving the tank, but permitting air to break the vacuum. The McNutt cans are constructed of high grade material and are designed to withstand severe service. The company also manufactures self-closing cans.

Heco Magneto.

The Heinze Electric Company, Lowell, Mass., is producing the Heco magneto, which differs from the usual types in that round magnets are employed, the company maintaining that greater efficiency is secured through a positive contact with the hole pieces. The make and break case is constructed of steel tubing with fibre insulation, the latter being shrunk onto the outside. The cover is removable without tools. The distributor case is of hard vulcanized rubber and the terminals are of the detachable type. The instrument is termed a low-tension in that the low voltage is stepped-up by a coil having primary and secondary windings. The current is distributed to the plugs by the magneto. The dash coil is of mahogany, and is equipped with a kick switch and push button for starting purposes. The Heco is constructed for one, two, four and six-cylinder motors, and owing to the special method of winding of the secondaries is guaranteed against burning out or breaking down.

Excel Auto Jack.

An auto jack that presents practical and interesting features is the Excel, marketed by the Excel Auto Jack Manufacturing Company, 27 Lansdowne street, Fenway, Boston. It is designed for both the repair shop and service station, is rapid and positive in its action, occupies but little room and is a time saver in that it can be operated without stooping or risk to the user. It is provided with a swivel to permit of its use at any angle, and a toe is included for service where the top piece is too high. The initial adjustment is instantaneous and the jack has a lifting capacity of 6000 pounds. Its height when raised is 25 inches, when closed nine, and the weight 25 pounds. It is made of steel, the housing being cast steel and the lever a steel forging. The carriage is mounted on rollers, making for convenience, and the jack lifts from either hub or axle.



Illustrating Some of the More Recently Announced Accessories Applicable to the Commercial Vehicle, Repair Shop, Etc.

THE A B C OF MOTOR TRUCK IGNITION.

Part XI—Explaining the Operation of a Dynamo and How a Direct Current Is Obtained—Construction of Interrupter or Make and Break Mechanism Utilized for Breaking Primary Current of Magneto.

By C. P. Shattuck.

REFERENCE has been made to the dynamo or generator and it was pointed out that it differs from the magneto in that electro-magnets are em-

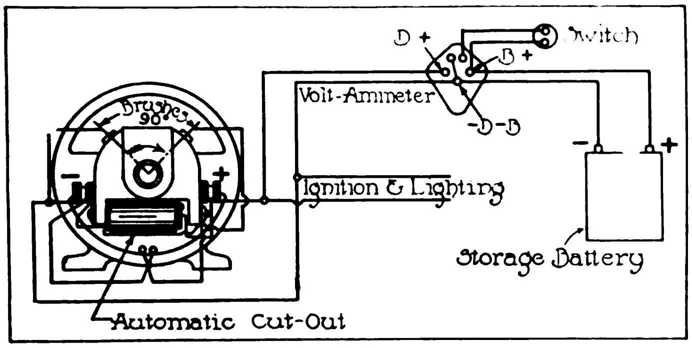


Fig. 54—The Apleo Dynamo Supplying Current to Storage Battery Which Is Floated on the Line—All Electricity for Ignition or Lighting Is Drawn from the Cells.

ployed insead of permanent. An electro-magnet is constructed by inserting a bar of soft iron, wrought or cast, within a coil of insulated wire, preferably copper, on account of its high conductivity. By passing a current through the wire coiled about the iron core, the latter becomes magnetic, attracting iron and steel bodies, and in general exerting an observable effect upon any polarized conductor, such as a solenoid. As soon as the current is cut off the iron core loses its magnetic properties. If a core of hardened steel be substituted for the iron and a strong current be sent through the wire, the metal will become a permanent magnet, retaining its characteristic magnetic effects for a practically indefinite period.

A bar of iron or steel thus temporarily or permanently magnetized invariably shows the phenomenon of polarity, the poles always being determined as positive and negative by the points of the inlet or exit of the current, as in solenoids. The magnet can also induce a momentary current in a closed circuit of wire and in a similar manner to ordinary current induction.

It has been pointed out that the theory of electrical generation by mechanical means is that the lines of force of a magnet should be cut through, so that their strength and direction at any point or at any time should be made to vary constantly. In addition, it is necessary that there should be some means of collecting the current, resulting from the continual disturbance of the magnetic field, and supplying it to a circuit.

The wiring plan of a dynamo is presented at Fig. 55 with the components designated. It will be noted that the armature core differs from that of the magneto; that the windings are dissimiliar, and that the armature rotates upon the longitudinal centre line of its core. The armature carries a large number of coils of wire placed in planes which pass through the longitudinal centre line of the core. At the end of the core is a collector or commutator from which the current generated by the revolving of the armature is collected by brushes and led to the outside circuit. The commutator also serves to cause the current to flow continuously in one direction—or a direct current—as without this member the electricity generated would be alternating.

The generation of current, therefore, is by rotating the armature between the pole shoes, etc., and the faster the core is revolved the stronger is the current because the strength of the magnetic field is increased, due to the greater amount of current being delivered to the field coils. It is obvious that the dynamo is an excellent source of electricity when driven at a constant speed, but because of the need for regulating it, either by governors or electrically, the magneto is favored for ignition purposes as it may be driven at variable speed.

The dynamo or generator is now generally utilized for lighting on pleasure cars and a few commercial vehicles, the variable speed of the gasoline motor being compensated for by friction clutches, governors, electric controls, etc., and with several systems the storage battery charged by the dynamo is employed for ignition purposes as well. The use of a dynamo on the automobile is not new, the Apple Electric Company of Dayton, O., having marketed an ignition dynamo several years ago, a number of which machines are in service today. The battery is floated on the

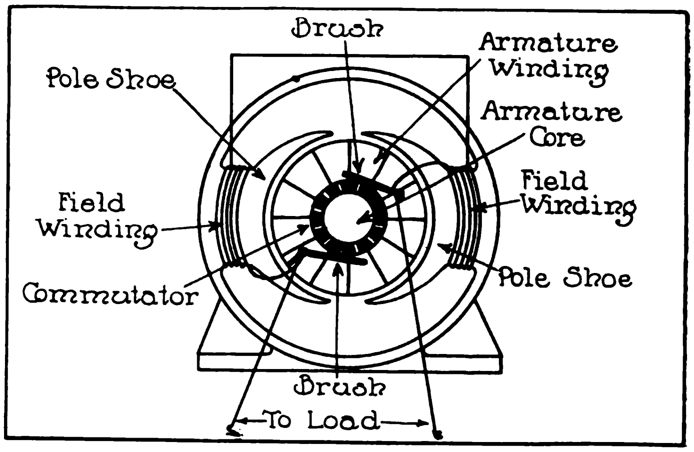


Fig. 55—Illustrating the Components of a Dynamo or Generator and How Direct Current Is Obtained.

line, the current from the generator being utilized to keep the cells in a fully charged condition. As will be noted by Fig. 54, which shows the wiring plan of an

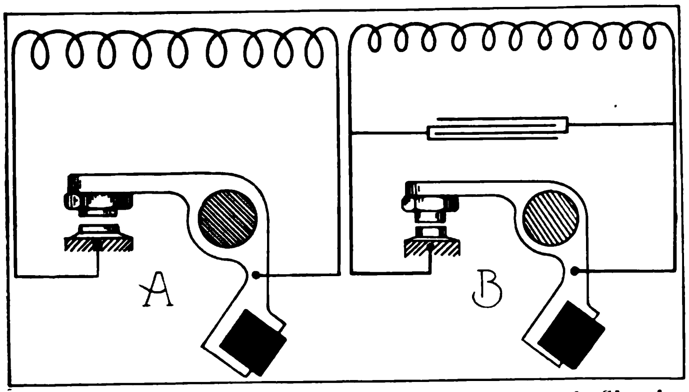


Fig. 56—Make and Break Mechanism of Magneto: A, Showing How the Primary Circuit Is Broken; B, Illustrating Use of Condenser, Employed to Prevent Burning of Platinum Contact Points.

Aplco dynamo, the electricity for either ignition or lighting, or both, is drawn from the battery. In the machine illustrated an automatic cut-out is employed to prevent the battery discharging through the generator when the voltage of the latter falls below that of the cells, which occurs when the armature is rotating slowly. The cut-out also is utilized to connect the generator to the cells when the proper charging value is obtained in the dynamo. The current is direct as an alternating one cannot be employed in charging batteries unless converted by a rectifier or other suitable device.

The current generated by dynamos is low-tension, and when employed for jump spark ignition purposes must be stepped-up or transformed by an induction coil. The process is identical with that of the battery and coil system previously explained.

Interruption of Primary Circuit.

In the previous chapter it was explained how current was induced in the windings of the H or shuttle type of armature and that the action occurred twice in each complete revolution of the armature. It was also shown that this primary current attained its highest efficiency or strength when the armature was in a certain position and that the nature of the current was alternating.

Irrespective of whether the instrument be a low-tension or a true high-tension, it is essential that the flow of the primary current be broken or interrupted just as it is with the commutator or timer utilized in the battery and induction coil system of jump spark ignition. For this purpose an interrupter or mechanical breaker is employed.

The simplest form of the make and break mechanism consists of two points to which the ends of the primary circuit of the magneto are connected. The drawing at Fig. 56 A shows these members with the positive and negative wires connected. With the two points in contact it is evident that the circuit is closed and that current is flowing. Upon separating the points the circuit is broken. The operation is very simple, and the circuit breaker or interrupter may be termed a switch.

Components of Breaker Device.

At Fig. 57 are shown views of the Bosch interrupter mechanism, that at A being a front view, while that at B is the rear construction. The components are lettered and it will be seen that the actuating parts are mounted on a metal disc, usually bronze or brass, bored and provided with a keyway for fastening securely to the armature shaft. The disc is further secured by an insulated screw which also serves to conduct the primary circuit to the contact piece. The latter is insulated from the metal disc by mica or other suitable material and the screw shown by the shaded lines in the sketch is also insulated. The contact block carries an adjustable screw retained in a predetermined position by a lock nut. The tip of the screw is fitted with a small hexagonal nut in which is imbedded a platinum point. The interrupter lever, which is pivotally mounted, carries a similar nut and platinum point, and a semi-circular spring tends to keep the two platinum points in contact.

The interrupter lever also carries a fibre block, which extends beyond the periphery of the metal disc, as will be noted at B, and when the block comes in contact with a segment it is depressed, which action separates the platinum points, breaking the primary circuit. The segments causing the separation of the points are stationary members, integral with the circuit breaker housing, the metal disc and its components revolving with the armature shaft.

One end of the primary circuit of the magneto is grounded to the armature core, while the other, or live end, as it may be termed, is connected to a brass plate, through the centre of which passes the screw shown at A, and to the insulated contact piece. The other side of the circuit is obtained from the armature core, the connection being established by the carbon brush, metal disc, interrupter lever and its platinum point. When both points are in contact the primary circuit is closed, but upon their separating a high-tension current is induced in the secondary winding of the armature or in the transformer, or step-up coil, it depending upon the type of magneto.

Time of Break.

The time of the separating of the points is of great importance and the maximum efficiency is obtained when the winding on the armature is cutting the great-

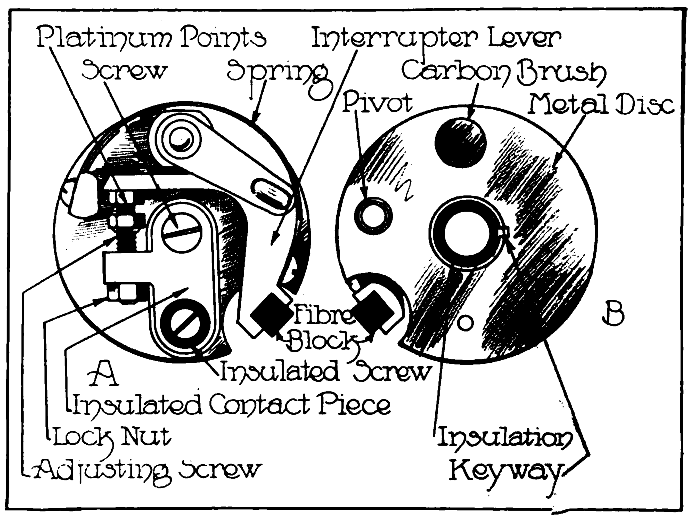


Fig. 57—Interrupter Mechanism of Bosch Magneto: A, Front View Showing Interrupter Lever and Fixed Platinum Point; B, Rear View.

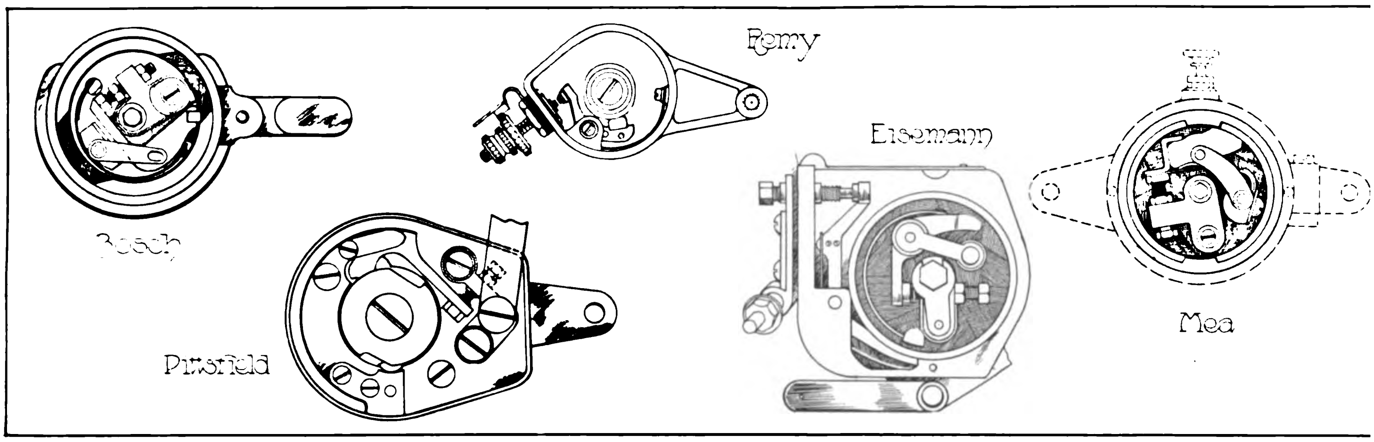


Fig. 58—Conventional Types of Magneto Make and Break Mechanisms, Including Bosch, Remy, Mea, Pittsfield and Eisemann.

est number of lines of force. It is at exactly these two positions that the current must be broken, and it is, therefore, evident that the mechanism causing the make and break must open and close in a fixed relation to the position of the armature.

That the interrupter mechanism does not always revolve with the armature shaft will be noted by the illustrations of conventional types shown at Figs. 58 and 59 respectively, although the principle involved is similar. By referring to the breaker box of the Remy magneto at Fig. 58 it will be seen that the armature shaft carries a two-point cam, which actuates the interrupter lever pivotally mounted in the breaker box proper. With this type the second contact point is an adjustable screw which is well insulated from the metal of the breaker box housing, and it will be seen that the primary current is established and broken twice each revolution of the armature shaft. A feature of the Remy breaker box is the ease with which adjustments may be made and from the outside. The gap or break of the points may be set when the magneto is operating. This is an advantage in that faulty operation at low speeds may be corrected easily. The Pittsfield utilizes a cam arrangement, as does the National, Connecticut, Kingston and Splitdorf.

The breaker box of the Eisemann, shown at Fig. 58, differs from the other types in that a separate circuit breaker is utilized when the source of current supply is batteries. It should be explained that with man so-called dual types of magnetos the batteries are util ized for starting purposes and for operation as wel but in the majority the circuit breaker of the instru ment is employed for interrupting the primary circui when the current is supplied from batteries and th magneto. The distributor, which will be taken up i the next installment, also serves to distribute the higl tension current. The advantage of the Eisemann ir strument is obvious. It permits of operating on th cells or battery even when the magneto circuit breake is defective.

Function of Segments and Cams.

The number of segments or cams utilized in th breaking of the primary circuit of the magneto de pends upon the number of cylinders. If it be a single cylinder engine there is but one break to each revolu tion of the armature shaft and but one segment em ployed, but with multi-cylinder motors, fours an sixes for example, there are two breaks to each revo lution of the armature. It is obvious that the contact are broken and re-established a great many times du ing a minute and that the operating parts must nc only be constructed of high grade material, but fir ished and adjusted with extreme care.

Distribution of Current.

The high-tension current of the magneto is sup plied to the spark plugs and in the proper order b the distributor, contact being made by the arm c

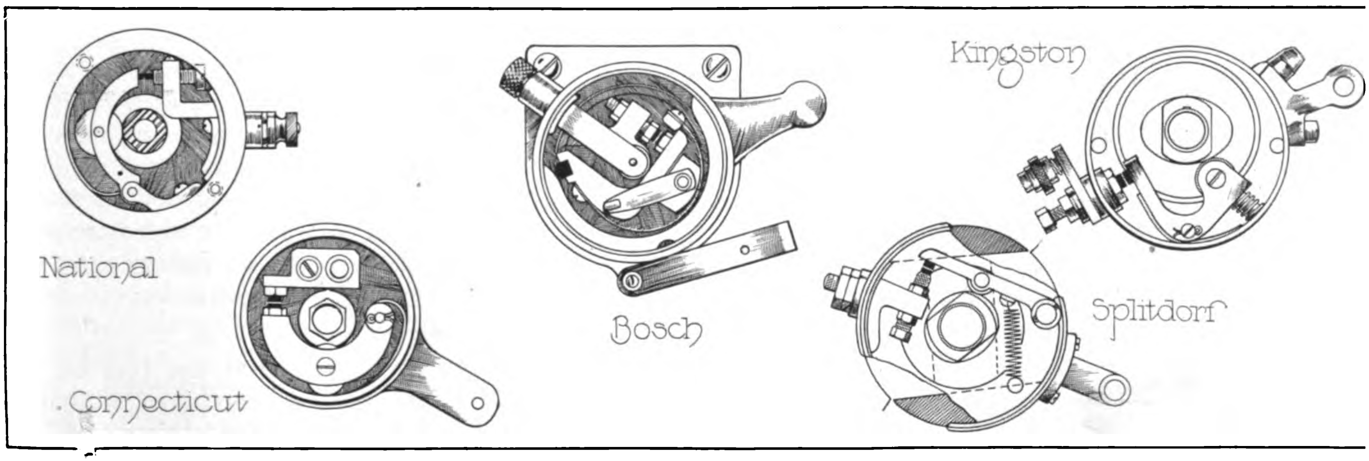


Fig. 59—Other Forms of Primary Circuit Breakers Showing National, Connecticut, Splitdorf and Kingston Employing Cams, and Bosch Single-Cylinder Breaker Box.

brush conveying the current to the segments. The principle is similar to that of the high-tension distributor utilized in connection with the coil and battery system of ignition. The distributor arm of the magneto is actuated by a gear in mesh with a smaller member secured to the armature shaft and rotating in an opposite direction. This arm makes but one complete revolution to two of the armature shaft, but during the movement contacts are made with four segments when a four-cylinder motor is being supplied with current.

To obtain a different number of sparks, as with a six-cylinder motor for example, the speed of the armature shaft is varied. Thus with the four-cylinder engine the armature is rotated at crankshaft speed, while with the six-cylinder motor it is driven at 1.5 times crankshaft speed. As there are but two breaks in the primary circuit each revolution, the armature must revolve three times in two revolutions or 1.5 times in each revolution of the motor to obtain the required total. In each 1.5 revolutions of the armature the distributor arm touches three segments. In other words, the distributor arm makes half a revolution to 1.5 of the armature.

(To Be Continued.)

Ed. Note—The next installment will deal with the construction of the distributor, showing how the high-tension current is supplied to the plugs. The various types of magnetos will also be discussed generally.

KISSELKAR TRUCK A CLIMBER.

Baggage Wagon Did Surprising Work in the West Hudson-Catskill Tour.

During the West Hudson-Catskill reliability tour, May 14-15, a two-ton KisselKar wagon carried the baggage of the tourists, and while it was not required that the machine take part in the competition, it was tested for the hill climb at Haines Falls, N. Y., where the most difficult grade of the route, the Kaaterskill Clove mountain, was ascended.

Carrying 20 persons and the luggage the climb was made in six minutes and two seconds, a work that can be the better appreciated when it is known that three of the leading pleasure cars took more than five minutes. In addition the wagon climbed the Crow's Nest hill, which was regarded as even a harder ascent.

PREMIERS IN TELEPHONE SERVICE.

One Light Motor Vehicle Does Four Times the Work of Single Horse and Wagon.

The Chicago Telephone Company three months ago purchased three Premier light wagons, made by the Premier Motor Manufacturing Company, Indianapolis, Ind., to be used for delivering instruments to new subscribers. The company's carefully kept records show the machines have averaged 115 deliveries a day against a delivery of 30 instruments by horse and wagon. In other words, one motor vehicle does in one day what the horse and wagon accomplished in four.

The delivery cost under the old method was 31 cents; under the new method it is nine cents. This quick installation establishes the subscriber as a dividend payer four times as rapidly as under the antequated method, thus making a still more economic saving.

COSTS LESS THAN SHOEING.

Result of Experience with Chase Trucks in Service with California Laundry Concern.

The Soft Water Laundry Company, Long Beach, Cal., operates one of the five largest laundries in southern California. The company installed a Chase motor truck originally and since then other Chase machines have been added until it now has a fleet of these vehicles in service. They are made by the Chase Motor Truck Company, Syracuse, N. Y.

The first wagon has operated continuously every working day for a period of 21 months. Manager Beck of the company states that he is willing to make affidavit that the entire repair expense covering this period of 21 consecutive months amounts to a total of only $3.65. He adds that during the next few months the concern will supplant its entire equipment of horses. It cost less, he asserts, to keep the first Chase truck in repairs than it would have cost to shoe one of the horses during the same length of time.

EMPLOYEES SHARE IN PROFITS.

Williams Foundry and Machine Company Distributes Liberal Portion Among Its Workmen.

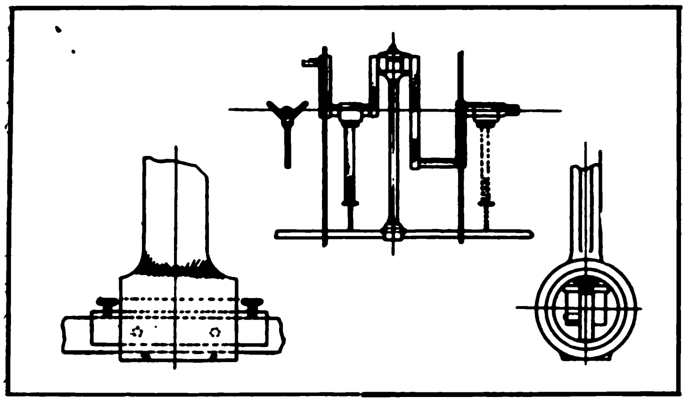
Each of the employees of the Williams Foundry & Machine Company, Akron, O., was recently presented by J. K. Williams, president and founder of the concern, with an envelope containing a substantial sum of money. An accompanying card stated the reason for the gift. The company has had a prosperous year and recognizing the part played by its faithful non-salaried employees dispensed among them $1500.

Five hundred dollars was divided according to the length of service with the company, by which was meant uninterrupted service, except for necessary absence, for more than a year previous to March 29, 1913, and $1000 was apportioned according to the number of hours worked during the year regardless of amount earned. Last year the company distributed $1000 among its employees and that labor troubles are and have always been unknown in its factory may be ascribed, in part at least, to the above action.

After a series of interesting tests, the DuPont de Nemours Powder Company has purchased a Studebaker delivery car, made by the Studebaker Corporation, Detroit, to carry detonators on a route through the Pennsylvania and West Virginia mining districts.

HINTS FOR PROPER MAINTENANCE.

ALTHOUGH one may be careful in fitting and scraping bearings, this does not necessarily mean that the axis of the bearing will be exactly in



Special Straight Edge for Verifying the Alignment of Bearings with Wristpins, Etc.

line with the wristpin. The centre line of the wristpin bushing will frequently be found to be inclined toward the centre line of the crankshaft, owing to the fact that the connecting rod has become slightly bent or out of alignment. It is not always easy to detect the defect before assembling and to facilitate matters the special straight edge shown in an accompanying illustration will be of service.

If it is used in connection with a length gauge, one having a V block at one end and a screw extension at the other extremity, the slightest variation in trueness in the horizontal plane may be noted readily. Similar misalignment in the vertical plane may be discovered by using an ordinary straight edge. It will be noted that provision is made for adjustment in order that worn wristpin bushings or those of larger or smaller dimensions than standard may be accommodated, two set screws being provided for this purpose. Other set screws in the side of the straight edge permit of taking up any slack sideways.

REMEDYING SLIPPING CONES.

Some of the older types of pleasure cars, a large number of which have been converted into delivery vehicles, are fitted with ball bearings which are adjusted by moving the outside cone on the spindle toward the hub. When the cone has been replaced a number of times the spindle becomes worn and the cone does not fit snugly, resulting in its rotating with the wheel. This condition brings about friction and wear of the spindle and adjusting nut. When it is found that the cone is slipping it may be cured by taking a small cold chisel and nicking the spindle so that a drive fit of the cone is secured.

LUBRICATING VALVE STEMS.

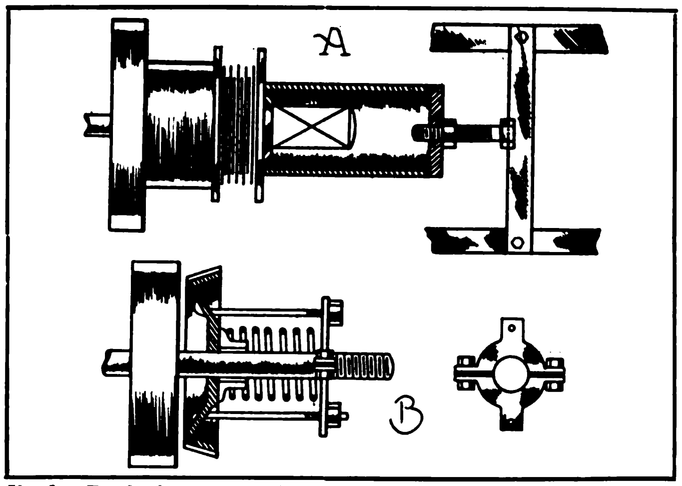
In grinding in the valves of the motor it is essential that they be cleaned before replacement. As the valve stems and their bearings are subject to considerable friction it is advisable that the stems be well lubricated before being replaced in the cylinders. Failure to provide proper lubrication is apt to result in undue wear and in the admission of auxiliary air. Grease or oil does not serve as the heat causes these lubricants to dissipate. The best method is to employ a grease graphite, smearing the stems, or to use a powdered graphite mixed with oil.

JIG FOR CLUTCH SPRINGS.

Unless one be careful in replacing clutch springs the fingers and hands are apt to be injured. A simple and easily constructed jig for replacing multiple disc types is shown at A in an accompanying illustration. It comprises a tube of sufficient inside diameter to slip over the shaft and a plate equal in diameter to that of the tube. The plate is drilled to take a .625-inch bolt, which is fitted with a nut. The head of the bolt is cut as shown so that it will not slip when the nut is screwed up. The jig shown at B differs from the one described in that it is applicable to cone clutches, and as will be noted, the plate member is made in two pieces or halved, so that it may be removed easily.

RESTORING DRY CELLS.

With some dual systems of ignition dry cells are utilized for starting the motor, after which the current from the magneto is switched on. As the cells are used only for starting they are not given the attention they would be were they employed for running purposes. Various methods are given for temporarily restoring dead dry cells or those the amperage of which is too low to permit of starting the motor, among which may be named that of drilling through the sealing compound and moistening the depolarizer with water and vinegar. The following hint is given by a battery concern: Take a piece of hard wood and with a



Jig for Replacing Clutch Springs: A, Type Applicable for Multiple Disc; B, Showing Application to Cone Clutch.

light hammer drive down the material surrounding the carbon post. It is said that amperage is increased considerably by this treatment.

NEW KEROSENE AND BI-FUEL CARBURETORS.

ANNOUNCEMENT was made recently by the Findeisen & Kropf Manufacturing Company, Chicago, of a new combination Rayfield carburetor. It is the invention of Charles Rayfield, who also designed the conventional Rayfield carburetor, and is for service on traction, stationary and marine engines, although it is understood that the inventor is conducting a series of experiments with a similar instrument applicable to automobile motors. The operation of the new device is automatic, and it is held that a perfect mixture is supplied to the cylinders at all speeds and under varying loads when using kerosene, distillate or other heavy grade fuels. Water is automatically fed with the kerosene.

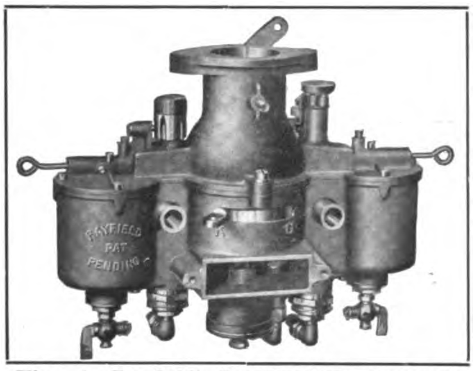


Fig. 1—Rayfield Combination Kerosene and Gasoline Carburetor.

As will be noted by the illustration at Fig. 1, two float chambers are provided. This permits the use of two separate fuels and makes it possible to start on gasoline in the conventional manner and to operate on that fluid if desired. Upon the desired heat being obtained the gasoline is cut out and kerosene employed. This is brought about by the movement of a small lever which controls the supply of both fuels. Two separate adjustments are provided. The required heat for vaporization of the heavy liquid is obtained from the exhaust manifold, a pipe connecting the latter to the air intake of the kerosene member.

NOBLE BI-FUEL CARBURETOR.

Among the more recent carburetors brought out abroad and designed for use with kerosene and heavy fuels is the Noble, an English product, part sectional views of which are presented at Figs. 2 and 3. It will be noted that two distinct float chambers are provided and that from each of these leads a jet, which is shown at B Fig. 3. The tip of each jet passes into a choke tube C, the bottom end of which is provided with means for adjusting amount of air passing the jet. Both choke tubes extend into the chamber D, which has a rotating sleeve valve. The latter makes it possible to cut off either the gasoline or kerosene, or to utilize both these fuels simultaneously.

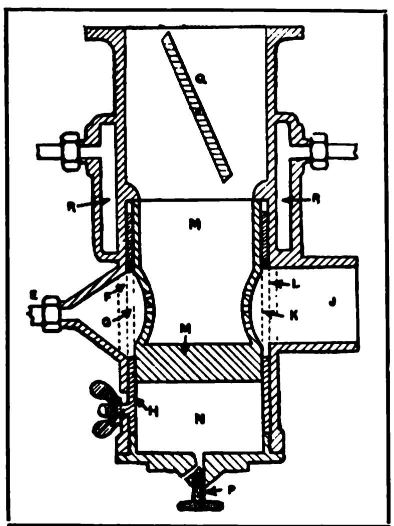


Fig. 2—Mixing Chamber of Noble Bi-Fuel Carburetor.

From the chamber D the rich mixture is led into a vaporizing tube E, which passes into and along inside the exhaust branch, finding exit through a packing gland at the front end of the motor, whence it is led to a mixing chamber illustrated at Fig. 2.

The gas from the vaporizing tube E passes through a slot F in the wall of the mixing chamber and a corresponding slot G in the sleeve H. The latter is employed for adjusting the proportions of gas and air to provide a correct mixture. Additional air enters the mixing chamber by the way of the pipe J from an open ended warming jacket around the exhaust pipe. The slots K and L correspond more or less according to the position of the sleeve H, which also has a rotary movement, so that these slots also work in conjunction with the slots F and G. The slots on both sides of the sleeve H are uncovered internally by a piston M, which rises or falls according to the negative pressure in the mixing chamber, this pressure being governed by the position of the throttle and speed of the engine.

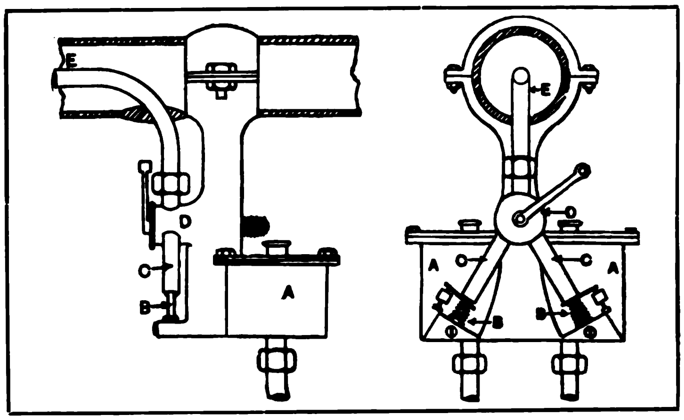


Fig. 3—Part Sectional Views of Float Chamber Portions of Noble Carburetor Utilizing Gasoline and Kerosene Independently or Together.

The piston M has holes communicating with the slots in the walls of the chamber, these apertures allowing the air and gas to pass through to the motor. Below the piston is a dash pot space N having an adjustable screw P. A hot water jacket R is also embodied in the mixing chamber casting.

The slow speed is adjusted by moving the sleeve H vertically, and when the desired position is obtained the sleeve is locked by means of a wing nut. The carburetor includes the conventional butterfly throttle valve, this being shown at Q and being located above the piston member.

The engine is started on gasoline and as soon as the exhaust pipe attains a certain temperature the two-way valve is utilized, bringing kerosene into service. In either case a rich mixture is provided, and the fuel is vaporized in its passage along the vaporizing pipe E. The level of both fuels is controlled by means of floats and needles in the conventional manner.

CORRESPONDENCE WITH THE READER.

Timing Valves of Ford.

(35)—What method is pursued in timing the valves of a model T Ford car? We use two of these in our business and the motor of one is not developing the power it should owing to wear of the valve stems. As the stems are not adjustable it would appear that either new ones would have to be used or the old ones drawn out. Is there any suggestion you can make? READER.

Schenectady, N. Y., June 15.

There are two methods employed in timing valves, one by the flywheel and the other by the piston travel. The latter is used with the motor mentioned and in an accompanying illustration is presented a timing diagram, the opening and closing points for the exhaust and intake valves being shown.

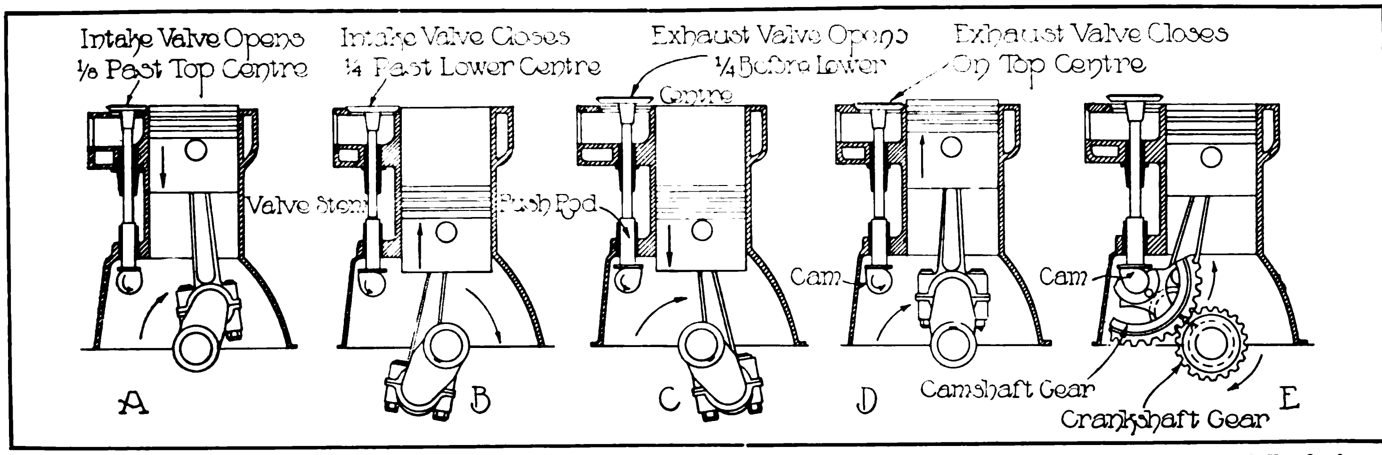
As will be noted by the diagram at A, the intake valve opens one-eighth past top dead centre on the completion of the exhaust stroke of that cylinder, the No. 1, for example. It should be borne in mind that there are four strokes to each cylinder, these being intake, compression, firing and exhaust, in that order. Consequently, in timing the intake valve of the first cylinder it should be open when the piston has completed one-eighth of the downward stroke or piston travel. As the stroke of the piston is four inches this is a simple case of mathematics.

The intake closes one-quarter past lower centre, or in other words, the piston has completed the intake stroke and has begun the compression stroke as shown at B. With the piston in this position the valve should be on its seat with a suitable space between the valve stem and pushrod or tappet as illustrated in the drawing. The timing of the exhaust valve is accomplished in a similar manner. The exhaust opens one-quarter before the piston reaches lower dead centre as shown at C and closes on top dead centre as illustrated at D. The valves of each cylinder should be timed separately.

The clearance between the valve stem and the pushrod should never be greater than .03125 inch nor less than .015625 inch. If the space is too small the valve is likely to remain partially open, causing faulty operation of the motor. It should be remembered that there is more or less expansion of the metal when hot and this should be taken into consideration in making fine adjustments, and when lengthening the stems or fitting new parts.

The lengthening of the valve stem involves considerable care and it is an easy matter to bend the stems. The better method is to utilize the Aplco valve stem adjusters, which are designed especially for this work. They are manufactured by the Providence Auto Parts Company, Providence, R. I., and are attached easily, being slipped over the stem.

The sketch presented at E shows the method of replacing the camshaft in the event of injury to this member or an overhaul of the motor.



Illustrating Timing of Valves of Model T Ford by Position of the Piston and Its Travel, Also Showing Method of Replacing Camshaft and Meshing the Gears.

Floating the Battery on Line.

(36)—In what respect does a lighting or ignition system with the battery floated on the line vary from others? What is the proper gap for spark plugs, and is there any difference between the space when used on the battery and the magneto? IGNITION.

Hoboken, N. J., June 11.

In a lighting or ignition system with the battery floated on the line, the generator or dynamo maintains the cells in a charged condition and all current utilized is drawn from the battery. A wiring plan showing the system is shown elsewhere in this issue.

The approximate proper gap for spark plugs is .03125 and .015625 inch, the latter being utilized where the source of current is a magneto. Too large a gap with magneto plugs is productive of missing at low speeds, etc.

Direction of Distributor Arm.

(37)—If the shaft of a magneto revolves to the right, in what direction does the distributor arm move? In replacing the plug wires, which would be the No. 1 cylinder? MAGNETO.

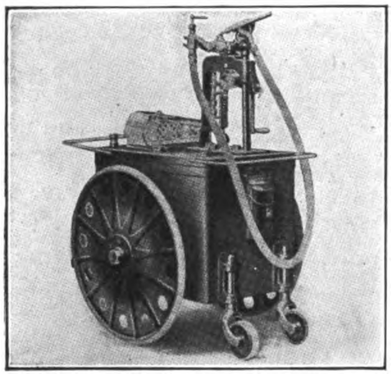
Toledo, O., June 8.

If the armature shaft revolves to the right or clockwise the distributor member rotates in an opposite direction as it is actuated by a gear meshing with another gear on the armature shaft.

In replacing the secondary wires the first cylinder to fire should be connected with extreme right terminal on the distributor housing. The proper connection may be determined by displacing distributor cover and noting position of distributor arm or brush.

GARAGE AND SERVICE STATION EQUIPMENT.

PORTABLE fuel tanks possess advantages in that considerable time is saved in replenishing the supply of gasoline in cars, to say nothing of the convenience. The American Oil Pump & Tank Company, Dayton, O., is marketing the American wheel tank shown in an accompanying illustration and designed to be moved easily about the garage.



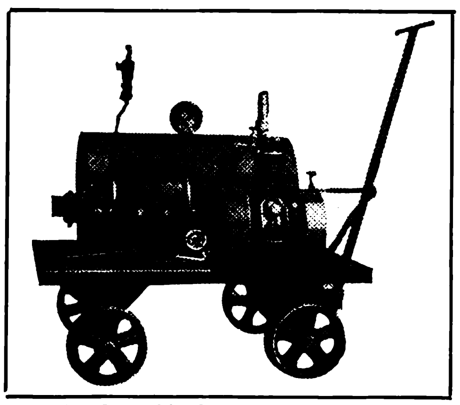
American Wheel Tank.

The tank proper has a capacity of 50 gallons and is constructed of .1875-inch metal, being seamless and reinforced internally. The handles and brackets which support the small wheels are welded to the body of the tank. The latter is carried in a steel basket frame having heavy uprights of steel to which are secured the spindles for the large pressed steel wheels. The steel frame passes underneath the tank, supporting it and eliminating strains. The large wheels rotate in ball bearings and are shod with Goodyear 1.25-inch solid tires. The small wheels are also rubber tired.

The tank is equipped with a wheel brake, contents indicator, properly screened filler pipe fitted with brass cap, and automatic gas and air vents. When specified the equipment also includes a triplicate autographic register and charge slip box, as shown in the accompanying illustration. The pump is a continuous flow member, equipped with a recording gallon meter, gasoline filter, two-way discharge, discharge register and spring lock. It is adjusted to measure a pint, quart, half-gallon and gallon, and it discharges on both the up and down-stroke of the piston. Four and one-quarter turns of the crank discharge a gallon and leave the pump ready for the next operation.

GARDNER AIR COMPRESSOR.

Compressed air in the garage may be utilized for a number of useful purposes. The Gardner Governor Company, 30 Williamson street, Quincy, Ill., is manufacturing air compressor systems both for the small garage and service station, including stationary and portable outfits, and operated either by the power of the garage or by electricity.



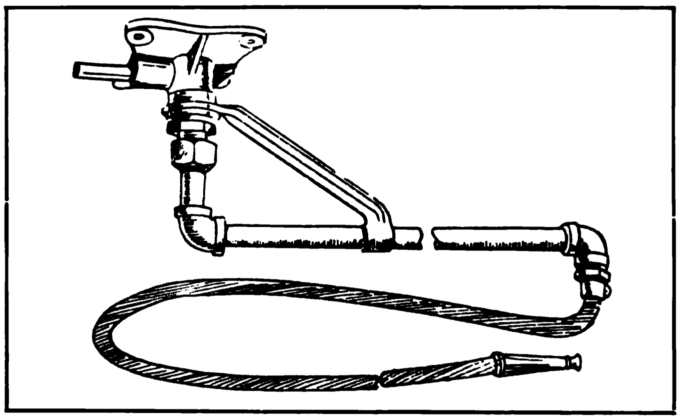
Gardner Air-Cooled Compressor.

The equipment shown in an accompanying illustration is an electrical unit and the design is provided with rollers so that it may be moved as desired, a construction making for convenience. It comprises a Gardner air-cooled compressor connected by gears with an electric motor, an air tank 14 by 26 inches, safety valve, pressure gauge and drain cock. Ten feet of air line with tire connection, 20 feet of lamp cord with socket and a tire pressure gauge are also included.

The air tank is not an absolute necessity with this unit, but it is frequently a source of convenience, especially where the outfit is moved beyond the zone of a lamp socket. In such cases the tank may be filled in the garage and it is stated that there is sufficient reserve capacity to inflate four large tires without refilling.

The Gardner air-cooled compressor is made of high grade material, is semi-enclosed, with trunk piston fitted with metallic packing rings. The crankcase and cylinder are one casting, and steel ball valves are utilized in the head.

The electric motor is a one horsepower, direct or alternating current, two or three-phase, 110 or 220-volt unit.



Walworth Swivelling Type Auto Washer, Designed for Attachment to the Ceiling.

WALWORTH WASHER.

The Walworth auto and carriage washer is the product of the Walworth Manufacturing Company, Boston, and the equipment shown in the accompanying illustration is of the swivelling type and is moderately priced. It is secured to the ceiling by lag screws, and the arm swivels horizontally in a complete circle, eight feet eight inches in diameter. The working parts are of brass, with other components of cast and wrought iron, heavily galvanized.

The washer not only enables the operator to reach easily any part of the machine, but the hose is kept off the floor, adding to its life. The complete equipment includes in addition to the washer and lag screws 15 feet of .75-inch three-ply hose with couplings, and a Boston spray nozzle.

BOSTON'S DELIVERY PROBLEM.

(Continued from Page 509.)

form of package delivery. In the shipping rooms the packages are collected, those in the store delivery room in grating compartments with a locked door. Beneath each compartment is placed a carrier, and this is locked as well. Unlocking the door releases the carrier and it may be drawn out and the packages dropped into it in a very brief time. In the other rooms the packages are placed in compartments and are removed to carriers from time to time. The provision for keeping the records is very complete and the records are exceedingly simplified. The possibilities with this equipment are splendid from an economic point of view, and while the store handles an average of 16,000 packages each day no less than 66,000 have been handled in a day, though, of course, the number of workers was materially increased. From every point of view labor is saved and the safety of the packages insured.

The carriers, when filled, are taken to the elevators from the shipping room to the street. There are four elevators on Avon street and four on Bedford street, but some of these are used for freight, and the greater part of the wagons are loaded in Avon street. The store has its own delivery equipment of three three-ton Packard trucks, one 1000-pound General Vehicle and four 1000-pound Commercial electric delivery wagons, nine 3000-pound Autocar delivery wagons and 55 wagons. The company's stable contains 135 horses and is in Harrison avenue. The electric wagons are garaged at the stable, the Autocars are kept at the Autocar service station, and the Packard trucks are kept at another garage. One of the electric machines, a Commercial, and the Packard trucks have been used three years, the other electrics about two years and the Autocars since last October. The drivers are paid $16 a week and the helpers an average of $9.

Four deliveries are made in the "city," at 10:30, 1:30, 3:30 and 5, and for this work horse wagons are used. The store equipment makes delivery in Newton once a day by horse wagon, in Roxbury, South Boston and Charlestown twice a day by horse wagon, in Chestnut Hill and Newton Center, Brighton, Medford and Allston twice daily by electric wagon, in Dorchester by electric and horse wagons, in Somerville, Cambridge and Brookline by gasoline and horse wagons, and in Newton Highlands, West Newton, Malden, Jamaica Plain, Forest Hills, West Roxbury and Roslindale, twice each day by gasoline wagon. Delivery is made once each day by expresses in Winthrop, Lexington, Everett, Stoneham, Wakefield, Atlantic, Arlington, Auburndale, Marblehead, Belmont, Saugus, Westwood, Blue Hill, Canton, Reading, Newtonville, Newton Upper Falls and Newton Lower Falls, and twice daily in Wellesley, Melrose, Dedham, Waltham, East Boston, Hyde Park, Salem, Woburn, Braintree, Quincy, Winchester, Lynn, Chelsea, Watertown and Revere. In addition there are the services of all classes of express companies and the parcel post.

All of the loading of the store, however, is by the elevators and carriers, and the packages are sorted and arranged in the wagons while they are standing at the sidewalks. Most of the loading is done in Avon street. The sidewalks are narrow and the street will permit one vehicle to pass with a vehicle standing at either sidewalk. This street is one way, all vehicles passing from Washington street to Harrison avenue extension, and it is used by thousands of shoppers who have their own conveyances. The traffic ordinance permits a wagon to stand five minutes unattended and 20 minutes when attended.

The wagons are lined along Avon street headed toward Harrison avenue extension, and from the main entrance to the annex to that street. In Bedford street they are similarly lined from Harrison avenue extension to the entrance. It is necessary to take the packages from the carriers and sort them for delivery, and aside from the awnings there is no shelter. The sidewalks are narrow and the streets are greatly used during the day. The system of loading here, however, is such that all of the wagons are not in the streets at any one time save when loading for the city deliveries. It would be practical, however, to load some of the wagons in Harrison avenue extension by making entrances and installing elevators at that end of the building.

At the White Store.

The store of R. H. White & Co. is located in the square surrounded by Bedford and Washington streets, Harrison avenue extension and Norfolk place. The shipping room of this concern is located in the basement at the corner of Harrison avenue extension and Norfolk place and the packages are taken to it by elevator and from the first floor by a chute. The company is now preparing to make material improvement in this department and this will include the most improved facilities that can be installed in the space that is available. The company handles approximately 1,000,000 packages annually, but this does not include the delivery from the contract department, which will undertake to furnish a room, a flat, a house or a hotel of any proportions, furnishing everything required for occupancy. The house does not sell provisions or groceries.

The goods are sent out of the shipping room by a small elevator and an entrance of moderate width, and the receiving is by a somewhat larger elevator. As is shown by the photographs the delivery elevator is at the corner of the building in Norfolk place, an alley that has a roadway of about seven feet with a 30-inch walk at either side. Wagons can be driven into this street and either backed out or driven through, but the walks are too narrow to load from. Harrison avenue extension, however, is wide and the wagons can be placed at either side of the street, but only loaded from one. Receiving freight sometimes interferes with loading, but the purpose of the shipper is to have the wagons and machines so relayed that not more than

six are at the store at any one time. The sidewalk is not wide, and there is a good deal of traffic in both the roadway and walks. The pedestrians, of course, interfere with the work to some extent, and there is no shelter in the event of storm.

The company uses two two-ton Garford trucks, a 3000-pound White wagon, two three-ton Mack trucks, two 3000-pound Autocars and two two-horse wagons, while in the regular store delivery are used nine 3000-pound Autocars, one 1000-pound General Vehicle wagon and 14 single-horse wagons. The store wagons make delivery in the "city" and in Allston, Ashmont, Auburndale, Beaver Brook, Bemis, Brighton, Brookline, Cambridge, Cambridgeport, Charlestown, Chelsea, Chestnut Hill, Cottage Farm, Dorchester, Dorchester Lower Mills, East Boston, East Cambridge, East Somerville, Faneuil, Forest Hills, Harrison square, Jamaica Plain, Longwood, Mattapan, Melrose, Neponset, Newton, Newton Center, Newton Highlands, Newtonville, Nonantum, North Cambridge, Oak square, Point Shirley, Revere, Riverside, Riverview, Roberts, Roxbury, Savin Hill, Waltham, Watertown, West Cambridge, West Newton and Winthrop. Deliveries are made by express services in 77 other different sections that are named on the shipping card, and these are regarded as the regular suburban delivery. Besides this there are the regular general and New England express companies and the parcel post.

Shepard, Norwell and Siegel.

The Shepard, Norwell Company's store is located between Winter and Temple streets and there is but one entrance to the store building from Winter place, this being a "blind" court that extends about halfway through the block to Temple street, there being a roadway about seven feet width and 30-inch sidewalks at either side. There is a bulkhead and an entrance for an elevator constructed for carrying freight, and at this entrance all the freight is received and all the shipments sent out. It is necessary to back any vehicle driven into the court out to Winter street, and Winter street is narrow and at all times in the day is congested. The delivery from this store is made by the Boston Parcel Delivery Company in the city, by a single General Vehicle 1000-pound electric wagon used in the Back Bay, and by the numerous local expresses. In the city the deliveries are made four times daily and elsewhere from one to four times a day. Of course the general and New England express companies and the parcel post service are used for places not reached regularly by the store service.

The Henry Siegel Company does not own motor vehicles, but it does its freight haulage and its delivery by about 125 horses. The store equipment is used in the city and the suburbs and the express services are employed as by the other stores, the radius of direct store delivery being within 10 miles, but not all localities are reached. The store rents trucks as they are needed for furniture delivery and it also provides for special delivery with rented automobiles. The shipping room of this company is in the basement of the building, the packages being collected on each floor and sent down through spiral chutes. They are sent to the different parts of the shipping room by belt conveyors and thence distributed to the different sections and placed in bins or carriers and the records made. Later on they are taken by elevators to the sidewalk. The store supplies and a considerable part of the stock is received at the elevator near the corner of Harrison avenue extension in Essex street, and the very large and bulky goods, especially furniture, are received and shipped at the large elevator in Haywood place. The parcels for the regular delivery wagons are taken in carriers to the sidewalk in Harrison avenue extension and there sorted and placed in the wagons. The sidewalks are narrow and the traffic is at times very heavy in them. It is not possible to load all the wagons at any one time, a dozen being the largest number that can be placed at the sidewalk, and frequently others are kept waiting at the other side of the street until there is loading space. Neither the Essex street nor the Hayward place sidewalks are used for loading. Here the same traffic regulations obtain. The greater part of the Harrison avenue sidewalk is partly covered by a canopy, but there is no protection for the vehicles. This store is advantageously located for a loading space within the building, for a drive could be made through the structure from Essex street to Hayward place.

The Electric Express.

Besides the express services that have been specified a factor that is of growing importance is the electric express, which is a combination of the Bay State Street Railway Company, the Boston & Worcester Street Railway Company and the Brockton & Plymouth Street Railway Company. This does not extend north of Boston, but it reaches Plymouth, Fall River and New Bedford, Mass., on the south, Newport, Providence, Narragansett Pier in Rhode Island, and Worcester on the west. A glance at the map will show the area covered by this service and its connecting lines. The Boston terminal is Copps Hill wharf, where all freight is received, and at 536 Harrison avenue is the express office. The company handles freight to all its stations, and express to all stations save those on the lines between New Bedford and Fall River, and Fall River and Providence. The freight service means transportation of any commodity from one terminal to another. The express is divided into two classes of service, the one where collection or delivery is made at one end, and the other where collection and delivery are both made. The former is known as the "B" and the latter as the "A" class. The company has an equipment of 20 wagons busy in Boston making collection and delivery, and it has its own vehicles or contract with owners of wagons for the handling of the packages in many of the towns and cities. The accompanying rate table shows the towns and cities where the "A" service can be given. The shipments are made eight times daily to points south of Boston and five times to points west of that city, so

there is certainty of quick deliveries anywhere the company has representation. In all 180 different places are now reached, and of these 118 are where freight only is handled.

Lack of space prevents a more detailed statement of the facilities of the stores and the endeavor made to expedite the work, but there is, for instance, between the Jordan, Marsh store and the furniture warehouse in South Boston a telautograph, by which, when an order is written by a clerk in the salesroom for a sale made by sample, the order is copied in the warehouse office and it is known to be correct and the record is complete. This is quicker than telephoning and it is a decided saving in time.

It would be impossible to estimate the number of vehicles used in the service of the stores and the express companies and it is impractical without this exact information and a precise knowledge of the work accomplished by each company to know what might be done in the way of motorizing these equipments. It is evident, however, that motorization would result in a decided street economy, that it would save the time of the men to a very large degree, but it is obvious, as the loading facilities are generally inadequate, that a complete change would be necessary to realize the greatest economies. There could be a decided saving with horse equipment, and a great deal more with motor wagons and trucks, but horse methods must be abandoned to obtain anything like what appears practical and possible.

To motorize the express companies would require different types of machines, for trucks would be necessary for direct haulage and lighter vehicles for distribution. The volume of business is increasing constantly and the requirements of the people are more exacting. The limitations of animals have been reached, and the solution of the situation must be in the utilization of automobile vehicles.

Harry Tipper, advertising manager of the Texas Company, former president of the Technical Publicity Association and a member of the educational committees of the Association of National Advertising Managers, Associated Ad-Clubs and Advertising Men's League of New York, has been engaged as a lecturer in the division of advertising of the school of commerce, accounts and finance of New York University, and will instruct in advertising science during the evening sessions of the college year of 1913-1914. Mr. Tipper's courses will include the psychology of advertising and selling, advertising campaigns and the essentials of advertising.

BUYS TEN WILLET WAGONS.

J. N. Adam & Co. Installs a Fleet for Its Buffalo, N. Y., Department Store.

J. N. Adam & Co., Buffalo, N. Y., which conducts one of the largest department stores in that city, has purchased and installed a fleet of 10 delivery wagons of 1500 pounds capacity, built by the Willet Engine & Truck Company of Buffalo. The firm is one of the chain of stores controlled by H. B. Claflin & Co., of New York City, there being 38 of these emporiums throughout the country, 35 of them being outside of the metropolis. The machines replace horse and contract delivery and it is expected that the improvement in the service will be materially reflected in the business transacted.

The Willet Engine & Truck Company first began to build a two-ton wagon, which is equipped with the four-cylinder two-cycle Willet engine, this having patented rotary valves and a number of exclusive features.

One of the Fleet of 10 1500-Pound Willet Delivery Wagons Purchased by J. N. Adam & Co., One of Buffalo's Largest Department Stores.

It is claimed for this engine that it is especially economical and enduring, has unusual power, and that it has been proven by eight years' experience.

As will be noted from the illustration the chassis is equipped with a half-panel body that is fitted with wire gratings at the sides and rear, curtains affording the necessary protection in the event of storm. The driver's seat is covered by a hood or bonnet that extends beyond the dash and in the seat side panels are ornamental oval plate glass windows. The chassis has a long running board and graceful fenders, these having a decidedly attractive effect, and the wheels are fitted with pneumatic tires. Drive is at left side and control levers are in centre at driver's right.

The annual convention of the Electric Vehicle Association of America will be held at Chicago, Ill., Oct. 26-27, and plans for this event are now making by a committee headed by Homer E. Neisz of the Cosmopolitan Electric Company of Chicago.

SECRETARY DRAPER RESIGNS.

Retires from Electric Motor Car Club of Boston to Engage in Business.

At the last meeting of the Electric Motor Car Club of Boston, held at the Hotel Thorndike the evening of June 19, the resignation of Business Secretary O. G. Draper was accepted to take effect as soon as his successor could be elected and sufficiently informed to take up the work of the club. Mr. Draper intended to devote his entire time to his duties as head of the O. G. Draper Advertising Agency, which has been established at 755 Boylston street, Boston. Mr. Draper was elected business secretary about the first of the present year and was very successful in the work, he also occupying a similar position with the New England section of the Electric Vehicle Association, from which he will retire.

At this meeting it was stated that the importance of the electric motor vehicle was such as to justify the presentation of a paper relative to its utility, at the annual convention of the New England section of the National Electric Light Association, to be held in September, and this paper should deal with the methods of promoting the use of the machines from every point of view. A committee of three was appointed to prepare the paper, and this committee was authorized to present whatever facts were believed necessary or desirable.

Two General Vehicle Electric Trucks, Fitted for Hauling Ice and Bottled Distilled Water, in the Service of the Consumers' Ice Company, Sioux City, Ia.

The club is making a campaign to increase its membership and a number of applications were received and the petitioners elected to the club. A series of interesting statistics relative to registration of electric vehicles in New England and in Massachusetts, both pleasure cars and freight wagons, was read by Secretary Draper, showing the number gained in the year ending June 14, and a summary of the charging stations in New England was presented. It was stated that this list of 208 stations would be amplified from time to time.

ELECTRIC TRUCKS AT PIERS.

Results with Fall River Line Impels New York Merchants to Advocate Their Use.

The traffic bureau of the Merchants' Association of New York City is advocating the use of electric industrial trucks on the steamboat and steamship piers of New York after careful observation of an installation of machines at the shipping terminals of the Fall River and Providence lines. Few persons, unless they have studied the conditions existing at those piers, understand the great loss through congestion and delay of vehicles, which is resultant from the methods of handling the freight. To illustrate, every incoming vessel brings freight that must be unloaded, and in the case of the lines giving daily service this means for several hours after arrival the docks are piled with packages and bales that must be removed. Then comes the flood of shipments that must be received at the piers and rushed on to the vessels and stowed.

At the piers of the lines stated a new receiving platform has been constructed, across which freight intended for shipment is quickly loaded upon electric industrial trucks, which are run upon the vessels, this eliminating much of the handling and increasing the efficiency of the dock facilities. This also minimizes the time for the trucks delivering the freights, for they are not required to wait in line for opportunity to enter upon the piers. The elimination of the hand trucks has the insurance of safer handling, and reduces breakage resultant from the overloading of hand trucks as the sailing time approaches and the men work with extreme haste. This also lessens the number of claims for damages.

So decided has been the improvement that the traffic bureau of the Merchants' Association, after inspecting the equipment and facilities, advocates the use of similar machines and methods on other piers with the hope of bringing about similar improvement.

The proposition of the Motor and Accessory Manufacturers to conduct a separate show at Madison Square Garden during the progress of the next New York automobile exhibition has not been approved to an extent that will seemingly justify its organization, and it is probable that the members of the association will make exhibits in connection with the car display. The option on Madison Square Garden will, however, be continued that there shall be no exhibition at that building that shall in any way compete with the automobile show.

ALL-MOTOR STORE DELIVERY SERVICE.

Arnold, Constable & Co., One of the Famous Dry Goods Houses of New York City, Has Used Electric Vehicles for 11 Years and Is Now Without Horses.

By F. Nelson Carle.

THE well known wholesale and retail dry goods house of Arnold, Constable & Co., was founded in 1827. The store is situated on 19th street and Broadway, New York City, and extends through to Fifth avenue. It is divided into practically two equal parts, the Broadway end being devoted to retail service and the rear half to the wholesale division of the business.

The firm has been without horses for three months. In fact, few horses sold at that time had been retained for the past two years, largely out of sentiment. The all-motor delivery equipment now consists of one 3.5-ton, two two-ton, two 2000-pound and seven 1000-pound General Vehicle electric wagons and a number of gasoline machines.

Arnold, Constable & Co., was among the pioneer users of electric wagons in the dry goods field. Significance is attached to the fact that the wagons bought in 1902 were numbered by the manufacturer 89, 90, 91 and 92 respectively. Other electrics of the same make were added in 1903 and 1906, and early in 1912, two 1000-pound wagons and one 3.5-ton truck were purchased. The gasoline machines have been in service about two years.

The Store of Arnold, Constable & Co., Looking from Fifth Avenue Toward Broadway—This End of the Store Is the Wholesale Department and the Other End Houses the Retail Division.

The directing head of the motor vehicle equipment is George H. Wilson, supervising engineer for the company. Mr. Wilson has been with this one firm 25 years and is one of the best informed men on automobile delivery in the world. It was largely through his patience and hard work that the machines bought by the company in 1902 and 1903 were kept in working order, or, for that matter, retained in service. The manufacturer built a good electric wagon and the battery people a relatively good battery, but it remained for Mr. Wilson to reduce co-operative theory to practise and to evolve a satisfactory method of garaging, charging and operating the wagons on regular routes.

Arnold, Constable & Co., maintains a splendid fireproof garage in Seventh avenue, at 16th street. The electric machines are cared for by a foreman, two battery men, a washer and two watchmen, the latter on night and day shifts. The garage was originally the firm's stable and housed the horses of the company. The empty stalls, old harness and one or two service-scarred, but aristocratic wagons backed against one wall, bear silent testimony to the passing of the horse in at least one phase of city delivery.

The two two-ton and one 3.5-ton trucks naturally serve the wholesale department and transfer goods principally in cases all over the downtown section and part of Brooklyn. The lighter wagons have more varied routes, one being assigned to Jersey, others to Harlem, Brooklyn and the Battery. Four Manhattan

The Twelve General Vehicle Electric Wagons and Trucks Outside of the Garage of Arnold, Constable & Co., Seventh Avenue and 16th Street, New York City.

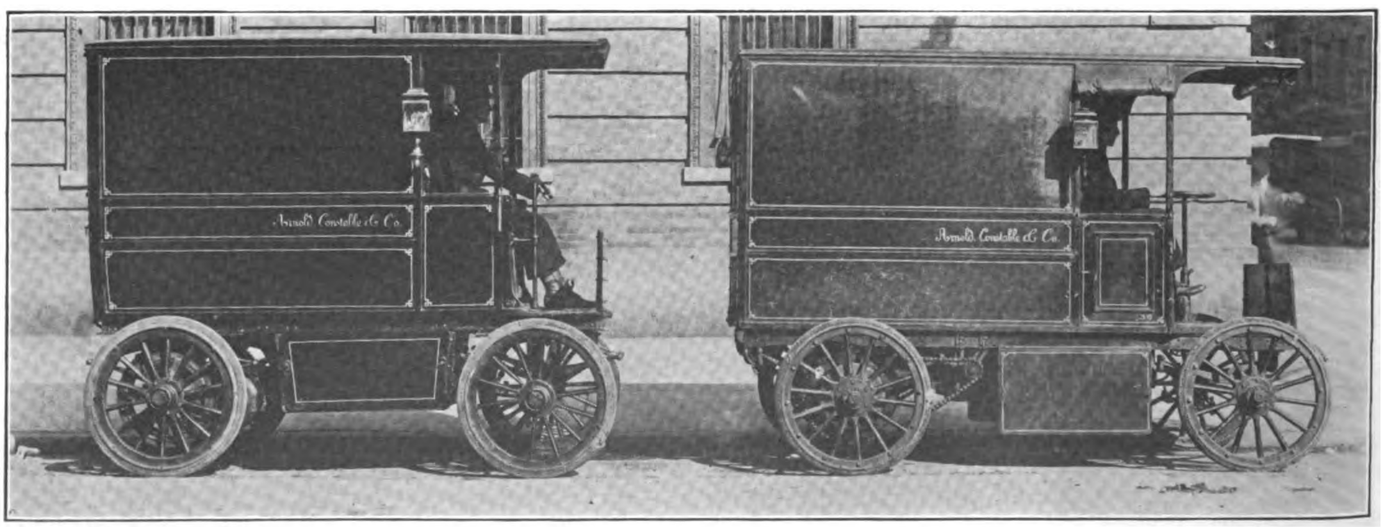
routes are known respectively as High East and Low East, High West and Low West. On all the routes three round trips a day are made and the 1000-pound wagons purchased in 1912 often negotiate up to 50 miles without boosting.

Since the leading dry goods houses of practically all cities regard it as bad policy to give out operating information which they regard as confidential, it is obviously difficult to obtain permission to publish not only specific economies effected by the use of automobile delivery, but even the details of routing the wagons, not to mention the upkeep cost of batteries, tires and similar items. The same applies in general to the wages paid the drivers. It is only by impressing upon the minds of the executives of leading firms the keen interest which other concerns in their line have in the success of pioneer users of motor delivery that even general information of helpful nature to others can be secured.

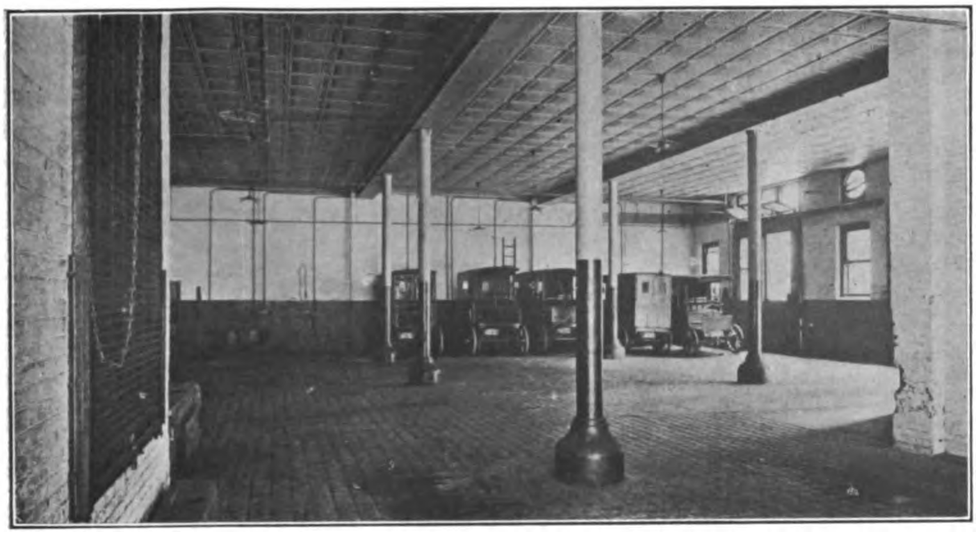
The older users seem to overlook the fact that if the leading department store in perhaps Denver or Omaha had one-tenth the operating knowledge of some of the older users, they could safely install a nucleus of motor wagons and then expand this progressively until they, too, were "horseless." It is true that manufacturers with a large distribution can give the beginner very helpful co-operation, but the new store looks toward the older leading store for advice just the same. The fact that the pioneer user indorses in general the adoption of motor delivery does not seem to be sufficient, and when one looks beneath the surface the reason is obvious. Each merchant imagines (and in some cases with reason) that his delivery problems are peculiar to himself or his city and that he cannot adopt more than a few features of successful installations in other cities. In, say, two years more, the various dry goods associations are certain to take up this general situation and much helpful information will be forthcoming in the discussions. It must be said, in justice to Arnold, Constable & Co., that it has at no time intentionally withheld the benefit of its long motor delivery experience from its brothers in the dry goods trade.

Old Wagons Too Good to Scrap.

"Yes, I suppose we will have to get rid of them some day," said Mr. Wilson, "but wagons 25, 26, 29 and 21 (put in service 11 years ago) seem relatively as good as ever. I have been told that we are behind the times and all that, but even if the wagons have paid for themselves long ago, there is no need of



Old and New Electrics in the Equipment of Arnold, Constable & Co.: That at the Left, a Pedestal Type, Built in 1902, and That at the Right Built in 1912.



Interior of the Garage of Arnold, Constable & Co., Showing About Half the Floor Space and Several of the Electric Machines on Charge.

throwing away equipment that is at the present time giving very satisfactory results. You must remember that it took us a long time to organize this service on a satisfactory basis—in fact, in the early days, we thought several times of going back to horses. We kept putting this off, however, thinking that we would sooner or later get the right combination, and sure enough we did. The problem looks very simple to us now, but you must remember we had no precedent to follow and had to work the whole thing out for ourselves. I think we really were pioneers in getting a satisfactory service, for the other stores expressed their surprise at our doing so well and the battery people couldn't then understand why we didn't buy new batteries every eight or 10 months, or even less, as some others had to do. Things were all pretty much mixed up at that time, but after we got hold of the principle of doing the thing right the rest was comparatively easy."

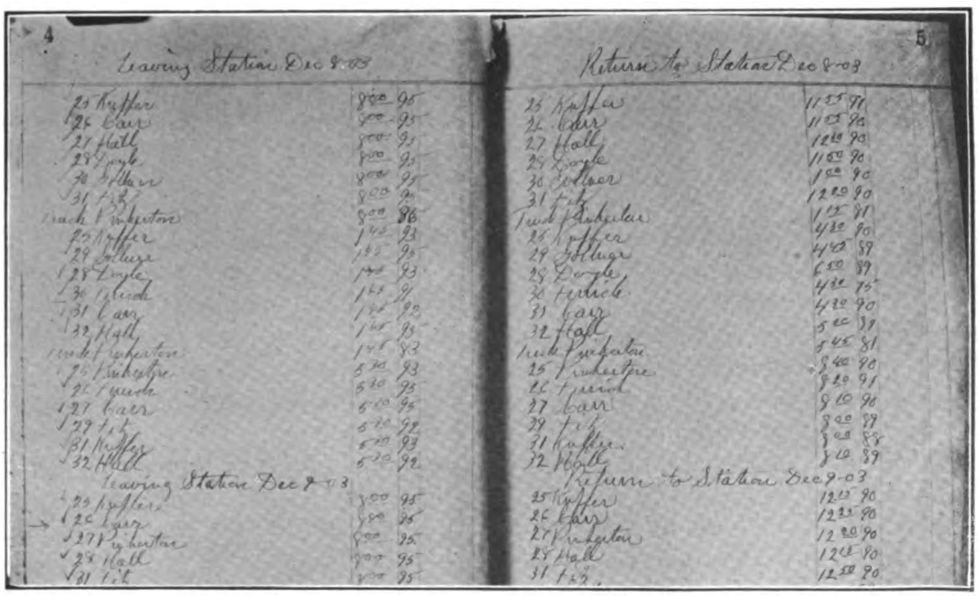
Mr. Wilson cites many amusing incidents of battery troubles, charging mistakes and originality on the part of drivers. Because of his pleasing personality and from his success as a pioneer operator, Mr. Wilson was naturally consulted by a great many others on electric wagon matters of common interest. At that time the charging panels available had no red light to indicate when the batteries were receiving the current. There was one garage where the machines were sometimes not properly plugged in, and occasionally after long charging the wagons would leave the garage, run about an hour and then become stalled. In another case, where he was called in to do first aid work, Mr. Wilson found that the garage man had cut four cells to see what the trouble was and had put the plates back with all the negatives in two cells and all the positives in the other two. He thought that all the plates which were alike naturally went together.

Secret of Operating Efficiency.

The question might well be asked: To what can we attribute the practically uninterrupted success of this pioneer user of motor delivery?

In the first place, the machines themselves were studied through the eyes of an engineer. Their strong points and their weak points were checked up as were their comparative performances under different conditions. Careful records of the four machines purchased in 1902 were put down on paper where they could be referred to readily, and right here is a point which is frequently overlooked by those who are buying their first machines today—11 years later. No elaborate card system was installed, but the figures were put down in black and white, as witness one method of record herein illustrated. There were no odometers or speedometers in 1902 and the bicycle cyclometer would not last more than a week on a two-ton truck. There was no ampere-hour meter until about 1906. However, by taking careful readings of each machine as it left and returned to the garage, the amount of current consumed in the last trip was determined and if additional current was required for making the next trip, the machines were boosted until the reading showed the necessary amperes.

An accompanying illustration shows two pages of a record book of the Arnold, Constable & Co.'s garage



Record of Trips of Electric Vehicles in the Service of Arnold, Constable & Co., Dated Dec. 8, 1903.

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that is dated Dec. 9, 1903, which is of much interest from the fact that it demonstrates one of the many conditions that were met with and overcome by the garage engineer. The record was simple enough, but its need and value are apparent. There were no indicating instruments such as are used today, that afford precise information at a glance, and yet the necessity of having this information, especially where exacting service was required, is apparent. Referring to the illustration and taking as an example No. 25 wagon, it will be seen that on the date specified it was taken from the garage at 8 in the morning with the battery reading 95 amperes, and that it was returned at 11:55, when the reading indicated 91 amperes. It was taken out the second time at 1:45 with the battery showing 93 amperes and was returned for the second time at 4:30, when the battery reading was 90 amperes. The wagon was taken out for the third time at 5:30 with the battery showing 93 amperes, and when it was returned at 8:40 the reading was 90 amperes. During the periods when the wagon was in the garage between the trips it was given "boosts" and the capacity so maintained that it was possible to drive it the distances required for the work. This information was kept with reference to each wagon, and aside from the name of the driver no other data were considered necessary so far the charging was concerned. Mileage data were not practical to determine save by estimate. There are 11 of these books in the office of the supervising engineer, in which are kept the operating records of as many years.

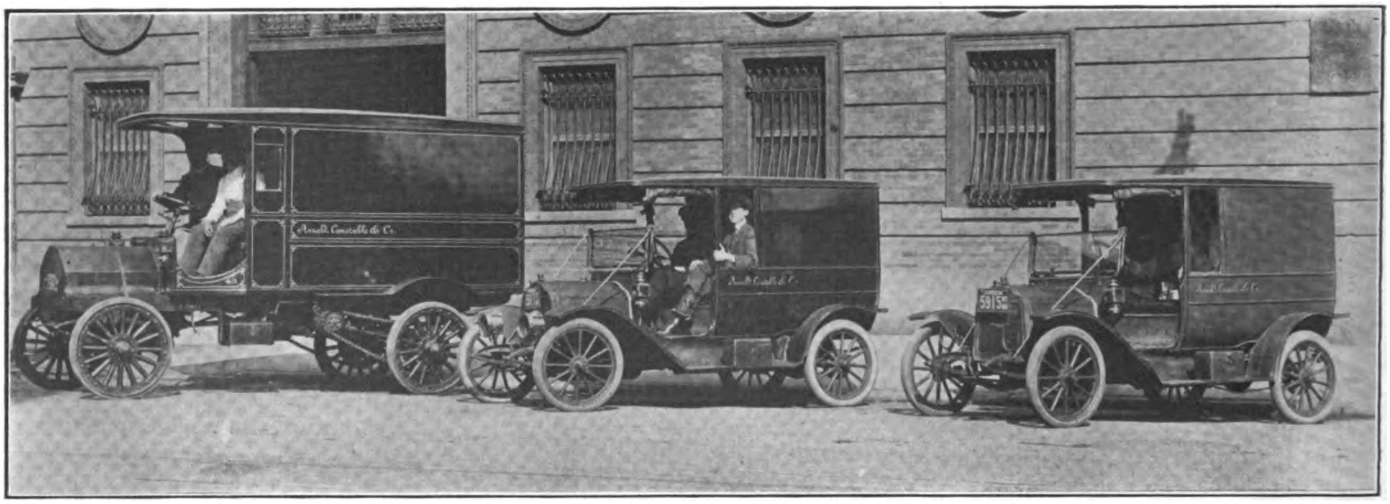
Each driver was required to test his brakes before leaving the garage so that he could not blame all collisions and minor accidents on the wagon itself. Batteries were studied and every weakness corrected as soon as possible. Experiments in routing were made continuously and the almost unbelievable distance of 60 miles a day was made by the light wagons as early as May, 1903. This might mean two short boosts for three trips, but each wagon was required to deliver the goods it started out with and with sufficient nursing it invariably did so.

With all these handicaps the superiority of the electric wagons over horses was soon apparent. They were much speedier, more flexible in heavy traffic and capable of covering far greater distances. They took up less room in the stable and were an expense only when working. In rush seasons and in bad weather they demonstrated their greater reliability as delivery units. And this in 1902.

Then, as now, the wagons left the garage at 8 and reported to the superintendent of delivery at the store at 8:15 sharp. The drivers were recruited from the horse wagons as their knowledge of routes was valuable and again some of them had been with the firm for many years. The men assigned to the 11-year-old wagons seem just as fond of them as they would be of a favorite horse. They take the "kidding" of drivers from other firms with good grace and not infrequently pass them stalled at that. Of course they are quick to appreciate the greater simplicity and other advantages of the newer models and look forward to the time when they, too, will drive the more modern type. The garage men seem divided between a desire to protest at the extra work on the old wagons and a feeling of pride that they have kept them in running order so long. While conceding that the 1902 and 1903 wagons are slow and noisy they will set no date for their being wholly worn out.

So it is a very simple story after all. Once you discover the right principle of operating a well built motor wagon, the rest is a matter of routine. The little things that come up are all in the day's work. Of course if the wagon is not adapted to the work you have a fundamental weakness to start with. The fact that all motor vehicles are machines and should be treated as machinery is important.

The self-propelled wagon requires more attention than its predecessor, but it is worth more—gives a far greater return on the investment. Arnold, Constable & Co. owes its success with them to its recognition of the principle underlying operating efficiency, and others may well give eyes and ears to a careful consideration of this important factor in motor delivery.



Three of the Fleet of Gasoline Delivery Wagons in the Service of Arnold, Constable & Co.

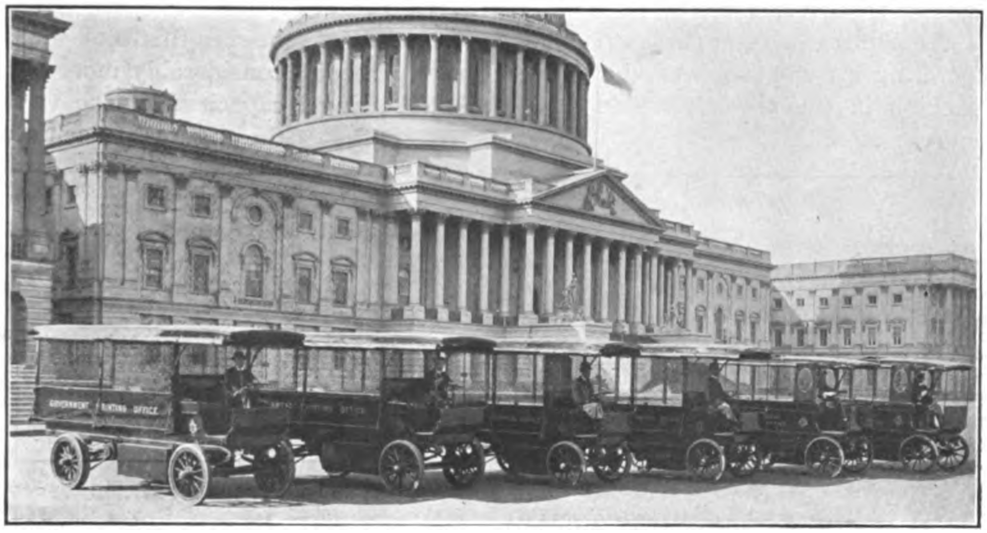
MOTORS SAVE MONEY FOR UNCLE SAM.

THE economy of the installation of Baker electric wagons used by the office of the public printer at Washington, D. C., has been established very effectually by an experience extending over more than a year and a half, and by accounting methods that are practical and certain. Six machines were installed in service in November, 1911, a year later the seventh was delivered, and the eighth was placed in the work in January of this year. From the facts determined there is no question of the saving accomplished as compared with the horse vehicles formerly used, and there is reason to believe that this ratio will be considerably increased.

There are a number of details in connection with the accounting that differ from those usually adopted for business houses. For instance, the government charges interest at 2 per cent., which is approximately 40 per cent. of the rate fixed by commercial practise, the wages paid average more than would be paid in regular delivery service, the work is for eight hours only and it is necessarily less in results, the government makes its own electrical current and there is no charge for this important item, while there is no allowance for garaging.

The equipment of the office originally consisted of 23 horses and a five-ton horse truck, seven two-horse wagons, eight single wagons, three mail wagons and six carriages, a total of 25 vehicles, and these, with harness and accessories, represented an investment of $16,530. In the stable section were employed 23 men, and in the delivery section 19 men, a total of 42, and the wages, rent, feed, supplies, repairs, shoeing and lighting amounted in the year ending June 30, 1911, to $31,231.93, and this, with depreciation allowance and interest, totalled $33,972.03. The total cost of the operation of the delivery section for that period amounted to the sum of $17,256.19.

The subject of motorizing the equipment was carefully studied and it was the opinion of the investigators that the government could save approximately $11,000 a year if electric wagons were used and the horses and vehicles sold. The report was acted upon favorably and in November, 1911, six Baker machines, two of 1000 pounds, two of 2000 pounds, two of 5000 pounds, were purchased, and 17 of the horses and much of the equipment disposed of. In fact the six horses, the five-ton two-horse truck, one heavy single wagon, one two-horse carriage and one single carriage remained, but the service was combination in character. At the expiration of a year a third 5000-pound wagon and an electric carriage were bought, and two carriage horses and one truck horse and the equipment were sold, this leaving but three horses, and when an 8000-pound truck was installed in January of this year two more truck horses were disposed of, this leaving a single horse. Prior to the installation of the electric machines the stable and the delivery departments were each under the supervision of a foreman, but when the motor vehicles were purchased the duties performed by the two foremen were combined and both departments were directed by one man.



Two 1000-Pound, Two 2000-Pound and Two 5000-Pound Baker Electric Delivery Wagons in the Service of the Government Printing Office at Washington, D. C.

Month	Salaries, Wages, Leave of Absence Holiday and Liability Payments Delivery	Stables	Garage	Material and Supplies, Repairs, Etc. Delivery	Stables	Garage
January	$1,429.23	$523.71	$818.23	$14.75	$149.85	$223.87
February	1,330.59	465.88	822.56	2.74	127.06	224.89
March	1,345.76	487.61	828.97	2.28	189.36	240.67
April	1,245.10	484.17	891.61	13.51	76.21	197.08
May	1,378.52	543.23	1,019.64	25.55	114.27	183.87
June	1,141.73	453.61	821.78	66.96	213.18	495.99
July	1,454.96	512.77	887.06	9.40	124.35	173.57
August	1,372.38	447.99	889.27	6.00	127.84	251.64
September	1,487.09	429.50	678.68	4.34	122.55	198.60
October	1,391.65	443.33	710.59	9.94	129.54	307.26
November	1,565.02	337.95	809.68	1.35	57.76	222.40
December	1,460.70	252.00	910.13	13.95	48.81	203.41
Total	$16,602.73	$5,381.75	$10,088.20	$170.77	$1,480.78	$2,923.25
Equipment issued Jan. 1 to Dec. 31, 1912.				$70.00		$24,446.00

Taking the motor equipment now in the service at the market value when purchased the investment represents $29,943, and during the year ending June 30, 1912, the delivery department employees consisted of a foreman, 12 drivers, three helpers, 10 messengers, one mail carrier, two messengers, four stablemen and four drivers, the wage cost amounting to $28,276.96. It is expected that this will be somewhat reduced in the statement for the year just ended.

Some very interesting figures are

shown by the statement on the preceding page of the cost of the stable and delivery from Jan. 1 to Dec. 31, 1912, including salaries, wages, leaves of absence, holiday and liability payments, material, supplies and repairs.

Examples of the work accomplished by the electric vehicles are shown in the following tabulation, these being one of each size of machines, summarizing the principal items and the cost of upkeep aside from the expense of batteries and tires, for there are no charges for these two items:

	1000-lb. Jan.-June	1000-lb. July-Dec.	1000-lb. Total	2000-lb. Jan.-June	2000-lb. July-Dec.	2000-lb. Total	5000-lb. Jan.-June	5000-lb. July-Dec.	5000-lb. Total
Total miles	3,013.00	3,510.00	6,524.00	2,978.00	2,864.00	5,842.00	3,586.00	2,918.00	6,504.00
Ampere-hours	8,598.00	8,459.00	17,057.00	11,019.00	9,710.00	20,929.00	18,302.00	14,096.00	32,398.00
Ampere-hours a mile	2.85	2.40	2.61	3.69	3.38	3.58	5.10	4.83	4.98
Kw-hr. supplied	1,249.8	1,303.80	2,553.6	1,573.6	1,389.4	2,963.00	2,678.4	2,047.8	4,726.2
Cost of current	$14.67	$16.64	$31.31	$18.58	$17.79	$36.37	$31.56	$26.28	$57.84
Battery upkeep	......	......	......	......	......	......	......	......	......
Tire upkeep	......	......	......	......	......	......	......	......	......
Electrical upkeep	1.20	2.93	4.13	0.75	14.38	15.13	5.06	8.67	13.73
Mechanical upkeep	26.80	27.68	54.48	41.34	28.41	69.75	129.62	80.10	209.72
Inspection	161.58	138.67	300.25	161.58	138.67	300.25	161.58	138.66	300.24
Totals	$204.25	$185.92	$390.17	$222.25	$199.25	$421.50	$327.82	$253.71	$581.53

the tires on the 5000-pound machines. They had worn for 13 months and it is probable would have endured for a considerable time more had not these machines been often loaded with 7000 pounds. At the end of the year the tires on the 1000 and 2000-pound wagons were in good condition and were seemingly good for perhaps six months more with normal service. The average load for the 5000-pound wagon is 5500 pounds, for the 2000-pound wagon 2500 pounds, and for the 1000-pound wagon 900 pounds. The average load for a two-horse wagon was 4000 pounds. It will be seen that the endurance of the tires would have been considerably more had the load been restricted to the capacities of the vehicles, for, with the exception of the lightest machines, they have been overloaded. The excellent condition of the streets made this overloading possible without excessive wear, but it is obvious that it was expensive when regarded from the viewpoint of tire cost. The expense for the present year, however, will include new tires, and, in all probability, reconstruction or renewal of the batteries. It is estimated that the cost of operating a 5000-pound electric vehicle is as follows:

An interesting comparison is made of the cost of operating a two-horse wagon and one of each size of machine in the service, which shows the following figures:

	Two-horse Wagon 5000-Lb. Capacity	5000-lb. Electric Truck	2000-lb. Electric Truck	1000-lb. Electric Truck
Average trips a day	4	8	8	9
Mileage a day, average	12	24	20	20
Mileage a month (loaded half way)	312	624	520	520
Average load a trip, lb	4,000	5,500	2,500	900
Total load a day, lb	16,000	44,000	20,000	8,100
Tons	8	22	10	4.05
Total load a month, tons of 2000 lb	208	572	260	105.3
Total cost a month	280.74	211.11	187.81	180.93
Cost a mile	0.899	0.338	0.361	0.347
Cost a mile (omitting driver's and helper's wages)	0.499	0.138	0.121	0.107

Relative to the work of the six machines in use until November, 1912, it is maintained that these did the work that was formerly done by the 23 horses and animal equipment, and that the horses retained practically did the increased work, so that in the government service the machines were actually equal to four horses each. This, however, does not exactly represent facts because of the difference in capacities. The 5000-pound wagons were regarded as easily doing the work of two two-horse wagons, and this in mileage as well as carrying capacity. It will be noted, however, that the figures show that the machines were not by any means worked to mileage capacity, and that as a rule the 1000 and 2000-pound wagons, with battery mileage of from 45 to 50 miles, carrying a half load the whole distance, were driven but 20 miles, assumedly a half of this distance loaded. But if fully loaded they were not worked to develop the greatest economy. As a matter of fact the streets of Washington are extremely well kept and are reasonably level, so that the batteries should give unusual service. Reference to the report will show that the expense for tires and for batteries was nothing, but shortly after the first of the present year it was necessary to replace

Cost of truck and equipment (including spare battery and parts)	$3,745.00	
Maintenance and repair (as per statement above)		$581.53
Depreciation at 10 per cent		374.50
Interest on investment at 2 per cent		74.90
Chauffeur's wages at $2.40 a day		751.20
Messenger's wages at $2.40 a day		751.20
Total original cost	$3,745.00	
Total expense for one year		$2,533.33

The records of the service are very accurately kept. For instance, the battery charging data are kept on a blank that is filled daily, this showing the battery number, date, time, volts, amperes, specific gravity and temperature. The daily meter record shows the numbers of the machines and battery and the date, the readings of the odometer and the ampere-hour meter when leaving and returning to the garage, the time absent and the differences between the two series of entries. Both of these blanks are signed and returned to the office each morning. These data and other facts are entered on the electric vehicle record each month, this

being a summary for the entire year, six months on each side of the card. This gives for each month the total mileage, ampere-hours current used, ampere-hours used a mile, kilowatt-hours supplied, cost of current, battery upkeep, tire upkeep, electrical upkeep, mechanical upkeep and inspection. The work slips of the mechanics furnish the electrical and mechanical upkeep data, and inspection covers washing, labor, charging batteries and general work of a miscellaneous character. Each machine is given a number and all the work, supplies and repairs are charged against each number from the slips and other records. This simplies the accounting and affords all desired facts.

EDISON HEARS SALESMEN.

Head of Big Battery Concern Learns Facts from Men on the Firing Line.

With a view of learning first hand of trade conditions throughout the country, and to formulate plans for the coming year, Thomas A. Edison called to the factory of the Edison Storage Battery Company at Orange, N. J., on July 11, a number of those in charge of the sales of batteries in the principal eastern commercial centres. There was much cause for gratification in the large increase of battery sales since January last, especially of the types used for delivery wagons and trucks, and the statements were that not only were the nickel-iron batteries doing all that was required of them, but the policy of the sales department has been promotive, productive and satisfying to the manufacturers and users of motor vehicles.

Thomas A. Edison and a Group of the Sales-Engineering Executives of the Edison Storage Battery Company at a Factory Conference at Orange, N. J., July 11.

It was stated that despite the unsettled conditions with reference to railroads and to business generally the orders for train lighting and signalling equipment were far in excess of the normal demand; that the use of batteries for house lighting for country homes, where central station current is not available, is larger than for the previous season and is increasing daily; that ignition and lighting batteries are a standard installation very generally used, and a much larger percentage of "replacements" are sold directly to the user. As the utility of the electric vehicle has been recognized in many localities and in practically every climate, the engineering sales force of the company has opportunity to use to excellent advantage, and for the distinct benefit of prospective users of motor delivery vehicles, a large volume of data and figures at its command. The value of accurate and dependable information relative to every class of service is very great and the salesmen have found it greatly appreciated by all considering vehicle equipment.

The accompanying photograph shows Mr. Edison standing in the centre of a group with Vice President and General Manager R. A. Bachman at his right and Manager of Sales William G. Bee at his left. The others in the group include Manager of the Sales-Engineering Department E. J. Ross, Manager of the Railroad Department H. G. Thompson, Manager of the House Lighting Department C. A. Poyer, Assistant Manager of Sales H. R. Leisk, Manager John Kelly of the New York office, Manager C. B. Prayer of the Chicago office, G. W. Holden of Boston and A. O. Heister of Buffalo.

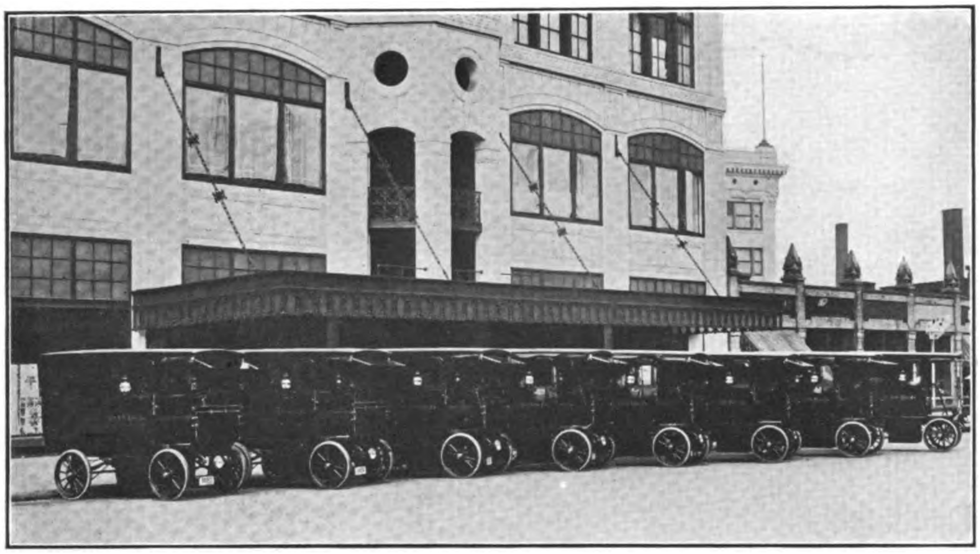
Three buildings of the plant of the Mais Motor Truck Company at Indianapolis, Ind., used for the storage of stock, oil and for general storing were recently destroyed by fire, but the main factory was not damaged and it was in operation the morning following. Aside from a slight delay in shipments there were no serious consequences. The factory has a considerable number of unfilled orders and especial effort has been made to complete these on time, despite the results from the blaze.

A. F. Mais has resigned as consulting engineer of the Studebaker Corporation and will take a rest before associating himself with another well known concern. Mr. Mais designed two Studebaker trucks, which were exhibited at New York last winter and which have been thoroughly tested and developed. These machines have not been produced commercially because of the need of all the factory facilities for producing passenger cars. They were of the internal gear driven type. Mr. Mais also designed the Mais truck, built by the Mais Motor Truck Company, Indianapolis, Ind.

ECONOMY OF MOTOR STORE DELIVERY.

THE experience of the Halle Bros. Company, which conducts a large department store at Cleveland, O., with its fleet of Baker electric delivery wagons, is worthy the consideration of every business man from the fact that the service has been improved materially and the cost considerably lessened. The company makes distribution to its customers in the city and suburbs and had used horse equipment until it was decided to utilize electric motor wagons. Cleveland is a city of large area and it has a fair proportion of good streets, but, like many of the newer municipalities, the improvement of the thoroughfares has not kept pace with the growth. For this reason there is not as great an advantage as might be assumed from the lessened congestion of traffic.

The company when it installed its motor equipment installed a very thorough system of records that it might determine accurately the actual expense of



Eight 1000-Pound Panel Body Baker Delivery Wagons in the Service of Halle Bros. Company, a Widely Known Department Store at Cleveland, O.

the service with a basis of cost a package, and the accounting included the wages of the driver, helper, insurance, depreciation, garaging, repairs, upkeep, and every item that could be logically charged to this department. In connection with this it should be stated that the machines were maintained to a high standard and they are today in splendid condition and are giving the best of results. It may be well to point out that the amortization of electric vehicles is usually fixed at 10 per cent. of the actual cost.

The delivery of every store of proportions will vary materially, and this is well demonstrated with this equipment, but the policy adopted was that when the number of packages was reduced below what was regarded as the minimum that could be profitably delivered, the routes were somewhat increased and one or two of the machines withdrawn from use for the period. This was done in the month of August and allowed the drivers and helpers to have vacations without employing additional help, and it continued the delivery at the desired standard of efficiency.

The result in actual expense is best shown by a summary covering the first year of service, this being an average of work performed that the cost per package might be ascertained. This summary is as follows:

Month	Average Number Packages Delivered Daily	Average Miles Travelled by Each Wagon Daily	Average Cost Packages Delivered (Cents)
November	164	36	4.0
December	247	35	2.7
January	180	33	3.2
February	151	34	4.6
March	191	37	3.8
April	161	34	4.1
May	186	38	3.6
June	161	38	4.2
July	164	37	4.2
August	138	35	5.0
September	156	39	4.6
October	169	38	3.9

These figures show that during the year the average number of packages delivered was 172.33, and the average number of miles driven daily was 36.33, while the average cost of delivery was 3.99 plus cents a package. During December, January, March and May the number of bundles delivered was greater than the average, but during the other months it was less, and the minimum number was in August, when 138 was distributed from each wagon each day. But it should be remembered that this figure was increased a wagon because of two being withdrawn from service during that period. While these machines were laid up the interest and other charges were charged against those in use, this being the fairest distribution that could be made, while, of course, no appreciable depreciation could be credited to these vehicles.

Examination of these figures will show that the cost a package drops in proportion to the volume of distribution, and by reference to the averages for December, when the mileage was below the average and the distribution was 43.6 per cent. more than the average, the cost was reduced to 67.7 per cent. of the average. When the distribution was smallest the cost was 25 per cent. more than the average, and the maximum cost a package was 85.1 per cent. more than the minimum. In other words, it cost 85 per cent. more to deliver a package in August than September, and had the two machines withdrawn been continued in service it is probable that this would have been increased to at least 100 per cent.

Considering the distribution, however, and understanding that the mileage covered does not materially vary, it will be seen that the elasticity of the service

has not been fully realized upon, because the machines have greater mileage capacity than the average shows was necessary. Further analyzing the figures it is evident that the full load capacity of the wagons is by no means reached. Not only this, the wagons can do much more work than is required of them, for they can be kept busy many more hours daily. There is reason to believe that with continued experience the operating cost can be somewhat reduced.

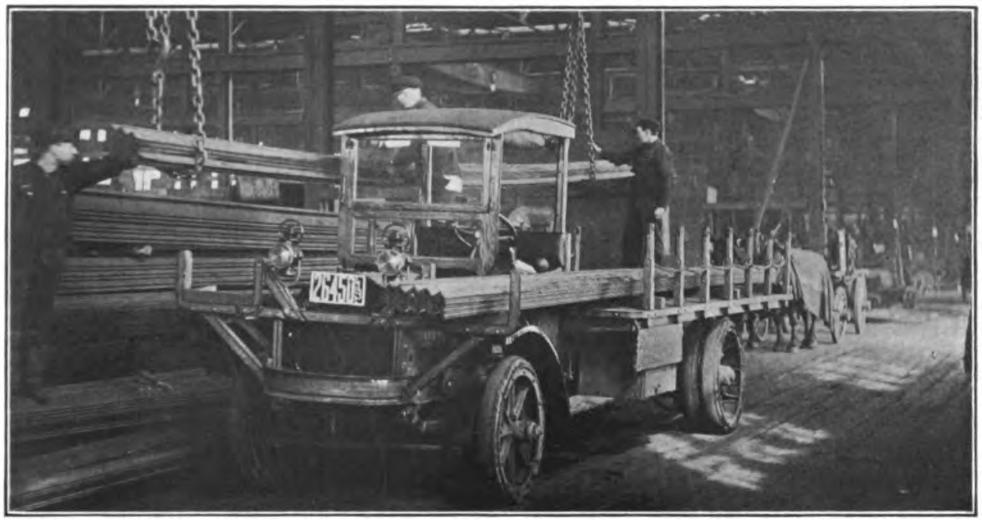
SCIENTIFIC LOAD HANDLING.

Successful Development of Methods Planned for Horses When Motor Trucks Are Used.

Seldom it is that such attention has been directed toward haulage economy that methods the vogue can be continued practically without change when the department is motorized. This means that receiving and delivery had been carefully studied, the conditions analyzed, and the needs for service determined, this with reference to vehicles and to facilities for handling. The Scully Steel & Iron Company of Chicago, Ill., determined to add motor trucks to its equipment, and that these might be used to the greatest advantage a careful survey was made of the different departments to decide what changes would be necessary or desirable in handling the stock, and what form of body would be best adapted.

So well had the stock department been planned and so satisfactory was the equipment that it was believed that only the vehicle bodies need be considered. When the first five-ton White truck was bought a body was built that had the standard stake platform and a frame that made practical the carrying of long lengths of metal. On the deck of the truck are three heavy oak cross members on which the load is placed, there being sufficient space beneath it when resting on the timbers to allow the easy withdrawal of the chain slings. At either side of the front of the truck chassis frame, and braced strongly, is a frame 18 inches wide and 12 inches deep which will support the forward ends of the long lengths of metal. There is sufficient clearance between the load and the hood so that there is access to the engine when the truck is loaded. When these frames are filled there is no load carried in the centre of the platform.

The trucks are driven into the stock department, which has wide aisles between the stocks of metal, and by chain hoists the order is lifted and placed on the trucks. The truck can be placed wherever desired and the hoists are of the trolley type that can be moved the length of the rails on which they are suspended. The accompanying illustration shows a truck on which are 40 long pieces of angle iron, and the same number is hoisted ready for placing on the machine. The construction of the frames supporting the forward ends of the load is clearly seen.



The Stock Department of the Scully Steel & Iron Company, Chicago, Showing the Hoists for Handling Metal and the Special Body Equipment of a Motor Truck.

KISSELKAR IN CALIFORNIA.

Fresno Owner Is Able to Undertake Large Transportation Contracts at Decided Profit.

L. G. Goodrich of Fresno, Cal., offers substantial proof of remunerative results of running a motor truck for hire in California. He owns a three-ton KisselKar, made by the Kissel Motor Car Company, Hartford, Wis., and uses it to haul products for ranchers and fruit growers in his vicinity. Following are some of the recent performances of the vehicle:

Hauling 100 tons of raisins from the vineyard to a packing house 4.5 miles distant, which was accomplished in six days; hauling 2600 orange trees a distance of 18 miles; several loads of bees and honey; turning the machine into a sightseeing car and transporting picnic parties, and general haulage in the city of Fresno.

For this work Mr. Goodrich received from $25 to $30 a day. As to the cost of operating his KisselKar, which he drives and cares for himself, he states that in the 7580 miles it has covered, he has never had a breakdown and but one repair, which was of minor consequence. In hauling the 100 tons of raisins his machine consumed only 12 gallons of California distillate and one-half gallon of cylinder oil. It is still running on its original set of tires.

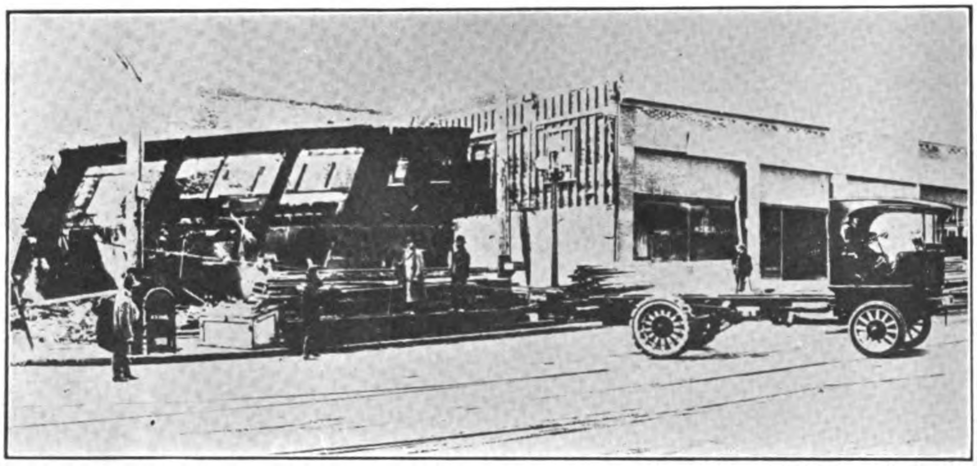
The Cleveland Macadam Company, Cleveland, O., which operates a five-ton White dumping truck in the haulage of crushed stone, has figures that show that the truck earned $500 a month for a period of 4.5 months, when it was constantly in use, it being loaded by gravity and dumped by the power of the engine.

RAZED BUILDING WITH TRUCK.

Garford Machine Used to Quickly Demolish a Structure at Seattle, Wash.

The wide range of service possible and practical with motor trucks is seldom realized, even by those who are constantly using them, and from time to time incidents are brought to the attention of the public which demonstrate how exceedingly useful a machine may be in conditions that were never considered by the most enthusiastic advocate of vehicle utility.

A case in point happened recently at Seattle, Wash., where workmen were demolishing a building and an official of the Waterhouse Trading Company, agent for Garford trucks and pleasure cars, was passing with a truck he was demonstrating. The men had the usual tools and were employing the customary methods to tear the timber apart. They had one wall standing and when this was attacked there was considerable danger because of the possibility of it falling. Safety could only be certain when the side of the structure was levelled to the ground.



The Demolition of a Building at Seattle, Wash., with a Garford Truck by the Waterhouse Truck Company of That City.

The truck salesman volunteered to pull down the wall if a rigging was procured, and so a stout rope was carried around the woodwork at a height sufficient to afford leverage. The other end was made fast to the rear axle of the truck, which was started forward on the lowest speed ratio. The wall toppled in a few seconds and fell, the work was done completely, and the power of the truck sufficiently proven.

MANY DART SERVICE STATIONS.

Distributing Points for Machines and Parts Established for Owners' Benefit.

The Dart Manufacturing Company, Waterloo, Ia., builder of delivery wagons, trucks and motors, is developing an organization that now covers a very large part of the country, it being the intention to afford to all purchasers of Dart machines a service that will be productive of the highest practical efficiency. This includes numerous distributing points, where machines of different types are carried in stock and ample supplies of parts available for owners. These stations are located where they will convenience the largest number using Dart machines, but it is proposed to extend these stations as the business conditions shall justify.

One of the examples of the service is the Dart Motor Truck Company of Massachusetts, Inc., located at 293 Northampton street, Boston, under the management of W. F. Magill. This company covers the New England states, and besides the stock of machines and parts it has a large and well equipped service station and all facilities for undertaking any character of work necessary in connection with the use of Dart wagons and trucks.

The company has announced that it is now ready to make delivery of the types of machines that will be produced for 1914, and in addition to the regular features, some of which are exclusive, the customers can have installed as extra equipment electric starting and lighting systems. The systems are not included as regular as there has been no change in the prices, and the high standard of material and workmanship is maintained. The company has adopted a selling policy that is expected to be promotive and benefit the small business men who might not feel disposed to take from their working capital at one time the cost of a machine. The company will make sales on a basis of one-third of the purchase price with the order, and the remainder may be paid in monthly installments.

The Dart Motor Sales Company, Mount Vernon, N. Y., has the agency for Westchester county in that state, and has already developed a substantial business, and the Dart Pennsylvania Branch at Butler, Penn., is the distributing point for the western half of Pennsylvania. Here an up-to-date service station has been established with full facilities and stocks of machines and parts. Contract has been made with the George Siegmund Company, 2025 Michigan avenue, Chicago, Ill., for the distribution of machines for the Central states and the maintenance of a high class service station, and there are other distributors in Los Angeles, San Francisco, Denver, Omaha, Minneapolis and St. Louis. In all of these points are direct representatives of the company, who can give attention to any requirement and guarantee service that will be satisfactory.

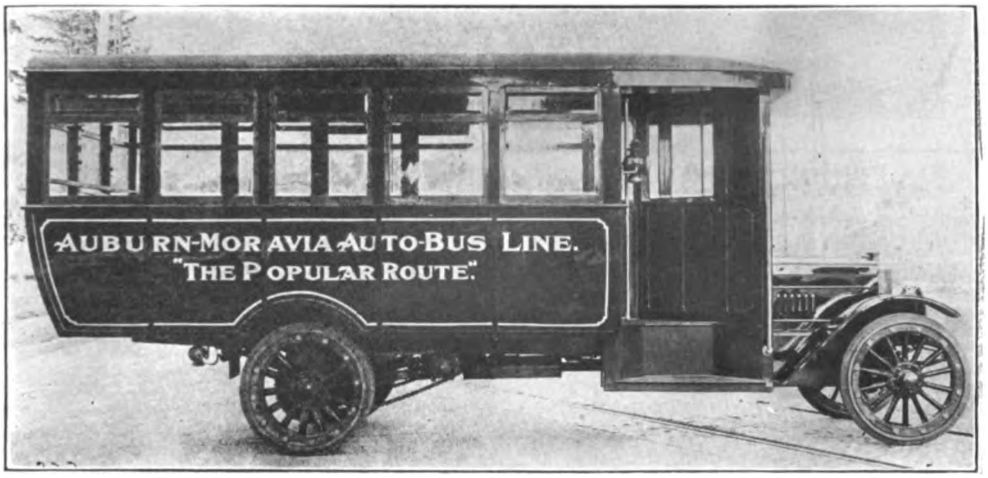
The Massachusetts law, which limits the weight of a motor truck and its load to 14 tons, and the weight of any vehicle to 800 pounds per inch of tire width, is now effective.

PAY-AS-YOU-ENTER MOTOR 'BUS.

Cleverly Designed Body Installed on a Two-Ton Atterbury Truck Chassis.

An automobile omnibus service has been established between Auburn and Moravia, N. Y., that affords the people of the two communities and of the section between them the first direct transportation they have ever had. The company is known as the Auburn-Moravia Auto-'Bus Line and it is using as its initial vehicle a two-ton Atterbury truck chassis on which is installed a cleverly designed body that will seat 25 passengers. The distance between the terminals is 23 miles and the fare is 50 cents, this being such as to induce a very satisfactory patronage. It is purposed to have the service permanent.

The omnibus is fitted with a body specially designed for the work, and it is what might be termed as car construction, with a single entrance, the passengers paying fares as they enter. As will be noted from the illustration the door is at the right side and this occupies half of the space that would ordinarily be taken for the footboards and driver's seat, there being a partition that extends diagonally from the dash to the front of the body. At the left side of this partition is the seat for the driver, the steering wheel and other control members, and the space for the driver can be enclosed in severe weather by a permanent windshield and a side curtain.



The Pay-As-You Enter 'Bus on Atterbury Two-Ton Chassis Built for Service Between Auburn and Moravia, N. Y., Having Capacity of 25 Passengers.

The body has five windows at either side, two rear windows and a window in the door and behind the driver, thus affording a full view in any direction, and these may be dropped in warm weather. The windows are curtained and between each window is a push button to signal the driver. The interior of the body is finished in the natural wood, this making for cleanliness, and the seats are of the street car type, each accommodating two, five at the right side of the body and six at the other, with a longitudinal seat at the right side of the door. The seats are very comfortably upholstered. The car is designed to stand with the right side to the curb and there is a single step that takes the place of the usual running board, there being hand rails at either side of the door. Short fenders cover the front wheels and the body is cut away over the rear wheels, the recess permitting the movement of the body and giving the necessary clearance. The body is ventilated by floor gratings. The lighting is by dome lamps in the body and side lamps at either side of the body. The chassis is a model C and is equipped with a four-cylinder motor that is rated at 40 horsepower.

FOUR CENTS A TON-MILE.

Baldwin Locomotive Company Operates 10 Five-Ton Saurers as Private Express Line.

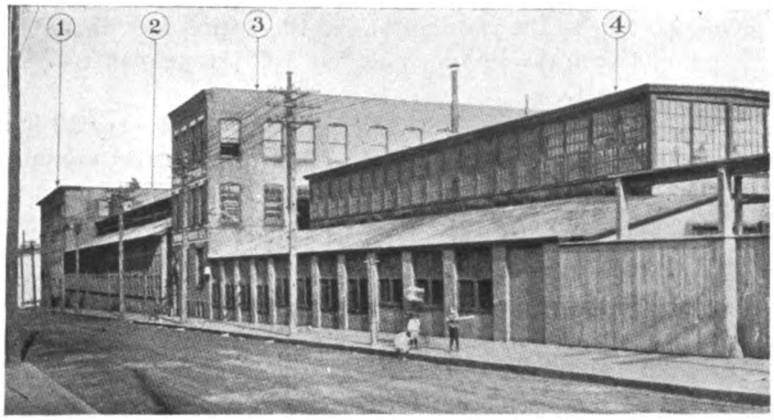
The fleet of motor trucks being operated by the Baldwin Locomotive Company, Philadelphia, Penn., has practically given the concern a private express line. The company originally purchased four five-ton Saurer trucks, made by the International Motor Company, New York City, and after operating them with the closest scrutiny gave a repeat order of six more of the same type. With the exception of an occasional trip to the railroad yards, the entire fleet operates between the Philadelphia and Eddystone plants, 13 miles apart.

Each truck makes two round trips every 12 hours, night and day, plus several miles of travel around the plants, taking on and discharging loads, making an average of 60 miles instead of 52. The machines are loaded, going and coming, generally to capacity, or 10,000 pounds, making 20,000 each round trip; 40,000 pounds carried every 12 hours; 80,000 pounds every 24 hours, year in and year out. As it costs the Baldwin company, according to its own figures, $12 a 12-hour day to operate each truck, this gives an expense of four cents a ton-mile.

This is a year of versatility of the motor truck and making one machine do the work of three, four and even five, is now the aim of the commercial vehicle builder. Contractors have peculiar lines of work and they have consulted with the engineers of automobile factories with a view of having service and efficiency greatly increased. Recently the Moreland Motor Truck Company, Los Angeles, Cal., delivered to a contractor a five-ton, 60 horsepower Moreland truck, with three bodies. The machine was equipped with dump and box bodies and a tank. These were interchangeable within 15 minutes and by this plan it gave the buyers practically three trucks at little more than the expense of one.

BRIEF NEWS OF MANUFACTURER AND THE TRADE

An opportunity for the establishment of an immense motor truck garage and repair shop has been created by the abandonment of the Providence, R. I., plant of the General Fire Extinguisher Company and the concentration of the business at Auburn, R. I., for this property, especially adapted for manufacturing purposes, is splendidly located in the centre of the wholesale, warehouse and manufacturing section of the city. The plant consists of five buildings having frontage of 507.82 feet on Exchange street, and the land has frontage of 219.30 feet on Bradford street and 257.12 on Cedar street, the area being 84,664.46 square feet. Four of these buildings have direct communication with each other, and the fifth is connected by two overhead passages. Building No. 1 is of brick, having heavy construction, three stories and high basement, 113.2x75.2 feet; building No. 2 is a high brick and frame foundry structure, splendidly built, 199.6x75.2 feet; building No. 3 is three stories and high basement, of brick, heavily constructed, 33.2x110.7 feet; building No. 4 is a brick and frame foundry, with monitor roof, about 120x55 feet; building No. 5 is a single story brick and stone structure 312.3x25feet, this being separated from the main buildings, but connected by two passages. The buildings are piped for steam heat and equipped with a Grinnell automatic sprinkler system, the latter affording very low insurance rates. The property is convenient to every business section of Providence and would be ideal for a garage and repair shop from every practical aspect, and is equally suited for any kind of manufacturing. Every information, illustrative and descriptive, can be obtained from G. L. & H. J. Gross, managers of estates, 170 Westminster street, Providence. The property will be sold as a unit, or divided into nine parts, on five of which are buildings. The buildings have a floor area of approximately 78,000 feet, and there is sufficient space unoccupied by structures to meet almost any character of expansion without adding to those now standing, if it would be desirable to retain them in their present form.



The Buildings of the Plant of the General Fire Extinguisher Company in West Exchange Street, Providence, R. I.

The Anderson Rolled Gear Company, Cleveland, O., maker of automobile and other gears, is incorporated with a capital of $100,000, and it is reported, will move to Toledo, O., in the near future. N. Anderson of Cleveland is president and A. Barker of Toledo is vice president.

The Pope-Hartford Company of Boston, Boston, Mass., distributor of Pope-Hartford trucks and pleasure cars, has found it necessary to erect a large addition to the already extensive service station on Hayward street, Cambridge, Mass. The new building will have every modern convenience for housing and caring for cars, and also the latest facilities for conducting quick and strictly first class repairs.

The Brown Automobile Company, St. Louis, Mo., for several years representative of the Peerless Motor Car Company, Cleveland, O., maker of Peerless trucks and pleasure cars, has been absorbed by the Peerless Motor Car Sales Company. Oscar Stroh is president of the new concern and F. G. Weaver will be secretary, treasurer and manager, positions he has held for 11 years with the Brown and Peerless companies. Mr. Stroh and Mr. Weaver have purchased the interests of J. R. and C. F. Brown and the business will be conducted along the lines that have already become well known.

Allan W. Fulton & Co., 720 East Pratt street, Baltimore, Md., has taken the agency for the Lauth-Juergens motor trucks, made by the Lauth-Juergens Motor Car Company, Fremont, O.

The Machine Manufacturing & Engineering Company, Council Bluffs, Ia., maker of automobile supplies and accessories, has plans to enlarge its business.

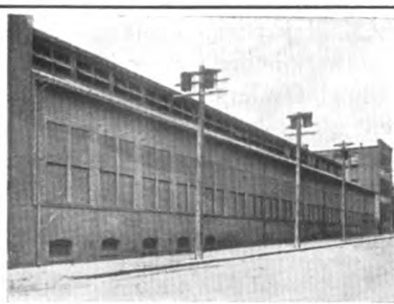
The Twin City Motor Car Company, St. Paul, Minn., northwestern distributor of Saurer, Mack and Modern trucks, and Maxwell pleasure cars, has moved into new quarters at 163 West Sixth street.

Charles E. Chadwick, one of the organizers of the Brockway Motor Truck Company, Cortland, N. Y., maker of Brockway trucks, has severed his connection with the company.

Clyde Thompson, formerly manager of the advertising department of the Diamond Rubber Company, Akron, O., maker of Diamond tires, recently taken over by the Goodyear Tire & Rubber Company, Akron, maker of Goodyear tires, has resigned.

The Velie Motor Company of Missouri, 5143 Delmar boulevard, St. Louis, Mo., announces the appointment of A. P. Bartlett as general manager of the newly incorporated company. Mr. Bartlett's experience in the retail automobile business in St. Louis extends over many years, and with W. J. Carter and C. F. Swartz to assist him, Velie owners in that territory will recognize in a very substantial way that the concern is most progressive. A new salesroom has been constructed and the office has also been re-equipped. A specialty of service to owners of Velie cars will be made.

Building No. 1.



Building No. 2.

Building No. 3.

Three of the Four Structures That Constitute the Main Property of the General Fire Extinguisher Company.

The Lewis Spring & Axle Company, Jackson, Mich., has absorbed the Lee & Porter Manufacturing Company, Buchanan, Mich.

R. C. Chase has resigned from the advertising department of the Packard Motor Car Company, Detroit, maker of Packard trucks and pleasure cars.

The W. J. Hughey & Son Company, Chicago, is building a factory for the manufacture of motor trucks at Prairie avenue and 33d street, to cost $100,000.

The Moreland Motor Truck Company, 1701-1731 North Main street, Los Angeles, Cal., is enlarging its plant, the new buildings costing $250,000.

Thomas R. O'Brien, maker of motor truck bodies, carts, etc., has secured larger quarters at Hubbard avenue and Dale street, Springfield, Mass.

H. H. Murden has been appointed factory manager of the Knickerbocker Motor Truck Manufacturing Company, New York City.

C. K. Thomas has been appointed manager of the Federal Truck Company, New York City, distributor of the Federal line, made by the Federal Motor Truck Company, Detroit.

R. M. Laird, Athens, O., has started an automobile 'bus line between Chillicothe and Bainbridge, O., with two large cars capable of seating 20 persons each.

The Monitor Automobile Works, Janesville, Wis., has ceased the manufacture of its two-cylinder model and in future will make its four-cylinder trucks exclusively.

C. H. Harvey has been appointed sales manager of the Eastman Motor Car Company, Philadelphia, Penn., distributor of Wilcox trucks, made by the H. E. Wilcox Motor Car Company, Minneapolis, Minn.

The Dreadnaught Tire Company, Baltimore, Md., has acquired a plant at Orangeville, Baltimore county, which is located on a four-acre site. It is being rebuilt for tire manufacture.

The Mogul Motor Truck Company, Chicago, maker of Mogul trucks, has leased a factory building at Maple avenue and the Wabash railroad, St. Louis, Mo., to which place it will move its plant.

The Gramm Motor Truck Company, Lima, O., maker of Gramm trucks, is to increase its facilities in the near future, according to an announcement made by President John N. Willys.

The Universal Motor Truck Company, Detroit, maker of Universal trucks, has begun work on a new addition to its factory. The plant will be practically doubled and the cost of the new buildings will be $250,000.

George W. Edwards, well known in St. Louis, Mo., has become manager of the St. Louis branch of the General Motors Truck Company, Pontiac, Mich., maker of G. M. C. trucks, with headquarters at 2815 Olive street.

Joseph Q. Goodie, who has been manager of the Detroit branch of the Diamond Rubber Company, has been appointed sales manager for the Pennsylvania Rubber Company, Jeannette, Penn. His headquarters will be at Detroit.

Charles Fisher, formerly Chicago manager of the Universal Motor Truck Company, Detroit, maker of Universal trucks, has been promoted to district manager and will handle the Middle West territory. He is succeeded at Chicago by C. P. Derr.

The Hendrie Rubber Company, Torrance, Cal., has practically completed its new plant, which cost $100,000, and the Pacific Electric Railway has commenced the construction of a special line to serve the plant.

R. S. de Milkiewicz, who has been connected with the truck department of the Peerless Motor Car Company, Cleveland, O., has resigned to affiliate with the New York City branch of the American Locomotive Company, maker of Alco trucks.

The Brady-Murray Corporation, New York City, has moved into its new quarters, having leased the first two floors of the 11-story building at 245 West 55th street. The company handles the Maccarr, Lansden electric and Smith commercial vehicles.

The General Motors Truck Company, St. Louis, Mo., is erecting a large service station and space is being made to accommodate 40 trucks, with an entrance to the building large enough to admit a five-ton machine. It is the first commercial vehicle garage to be established at St. Louis.

The Philadelphia Truck Association, recently formed, has held its first meeting and motor truck matters were discussed. The committee on publicity was instructed to issue a club organ. James Reed, Jr., assistant director of public works, Philadelphia, and E. S. Foljambe were the speakers at the meeting.

Fred Roble, formerly manager of the International Motors Company, Chicago, has resigned.

The Britton-Stevens Motor Corporation, Boston, Mass., has taken the agency for the Maccarr and Smith-Milwaukee motor trucks.

The Holcomb Company, New Haven, Conn., has taken the agency for the Adams trucks, made by the Adams Bros. Company, Findlay, O.

Frank N. Sim has become assistant advertising manager of the Timken-Detroit Axle Company and the Timken Roller Bearing Company.

George F. Russell has succeeded Joseph D. Porter as advertising manager of the Garford Company, Elyria, O., maker of Garford trucks.

The A. G. Hebb Auto Company, Lincoln, Neb., has taken the agency for the Chase truck, made by the Chase Motor Truck Company, Syracuse, N. Y.

The C. B. B. Motor Company, Washington, D. C., has taken the agency for the Selden truck, made by the Selden Motor Vehicle Company, Rochester, N. Y.

Gilardi & Faure, Sacramento, Cal., is representing the Kelly line of trucks, made by the Kelly-Springfield Motor Truck Company, Springfield, O.

C. E. Osborn has charge of the new service department of the Speedwell Motor Car Company, Dayton, O., maker of Speedwell trucks, at Van Ness avenue, San Francisco, Cal.

George Davis has become manager of the Dominant Motor Car Company, Buffalo, N. Y., agent for Packard trucks, made by the Packard Motor Car Company, Detroit.

Charles B. Warren, formerly general manager of the Haynes Automobile Company, Indianapolis, Ind., has become manager of the New York City branch of the General Motors Truck Company, maker of G. M. C. trucks.

R. K. Johnston, formerly of the Gramm Motor Truck Company, Lima, O., maker of Gramm trucks, has been appointed general manager of the Bowling Green Motor Car Company, Bowling Green, O., manufacturer of the Modern truck.

F. A. Calderwood, formerly assistant manager of the Lozier Motor Company of New England, Boston, has taken a similar position with the Boston branch of the Locomobile Company of America, Bridgeport, Conn., the maker of the Locomobile truck.

W. F. Wittenberg has been appointed manager of the Nevada Manufacturing Company, Nevada, Ia., a concern which has been formed to manufacture motor trucks and motor plows. Mr. Witttenberg was formerly sales manager of the Christian Engineering Company, Milwaukee, Wis.

The Milwaukee Tire & Supply Company, Milwaukee, Wis., has been appointed local agent for White pleasure and commercial cars, made by the White company, Cleveland, O. The new company will be known as the White Automobile Company, Milwaukee Tire & Supply Company, owners.

The Kentucky Wagon Manufacturing Company, Louisville, Ky., recently held its annual meeting. W. O. Harris, Jr., and Stuart E. Duncan were elected directors to succeed C. G. Strater and L. Allen. President W. C. Nones was re-elected, as were also the following directors: S. M. Nones, John Marshall, John C. Hughes, Bernard Bernheim, P. S. Tuley and James Glazebrook.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC.

Of **The Motor Truck**, Published **Monthly**, at **Pawtucket, Rhode Island**, required by the act of August 24, 1912.

NOTE—This statement is to be made in duplicate, both copies to be delivered by the publisher to the postmaster, who will send one copy to the Third Assistant Postmaster General (Division of Classification), Washington, D. C., and retain the other in the files of the postoffice.

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None.

Known bondholders, mortgagees and other security holders, holding 1 per cent. or more of total amount of bonds, mortgages or other securities:

None.

WILLIAM H. BLACK, Editor.

Sworn to and filed with Postmaster July 11, 1913.

ARTHUR H. CAPWELL,
Notary Public.

My commission expires June 30, 1914.

The
MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

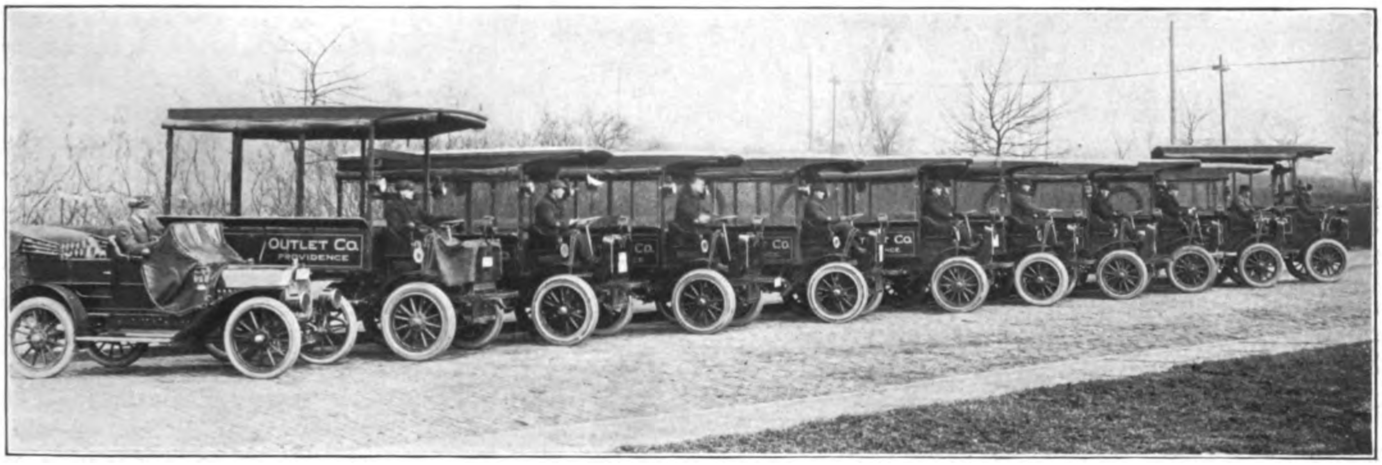
VOL. IV. PAWTUCKET, R. I., AUGUST, 1913 No. 8

HOW MOTOR WAGONS DEVELOP BUSINESS.

The Transportation Conditions in the Commercial Centre of Moderate Size and the Manner in Which Department Stores and Large Groceries Serve Customers Within a 15-Mile Radius—The Possibilities of Motorized Equipment.

By William W. Scott.

THE analysis of the transportation conditions in Boston and its suburbs, made by the MOTOR TRUCK, demonstrated the enormous duplication of service and the competition in systematized haulage. Turning from this locality to one of lesser proportions, Providence was selected as being the second largest city in New England, having the advantage of both water and railroad facilities and being a centre of distribution for central New England. Providence has a large coastwise commerce, it is one of the most prosperous of manufacturing communities, and it is especially advantageously located for competition with Boston.



Ten of the Fleet of 14 Machines Operated by the Outlet Company, Providence, R. I., Two of Which are Fitted for Furniture Delivery, 10 for Parcels and Two for Special Service.

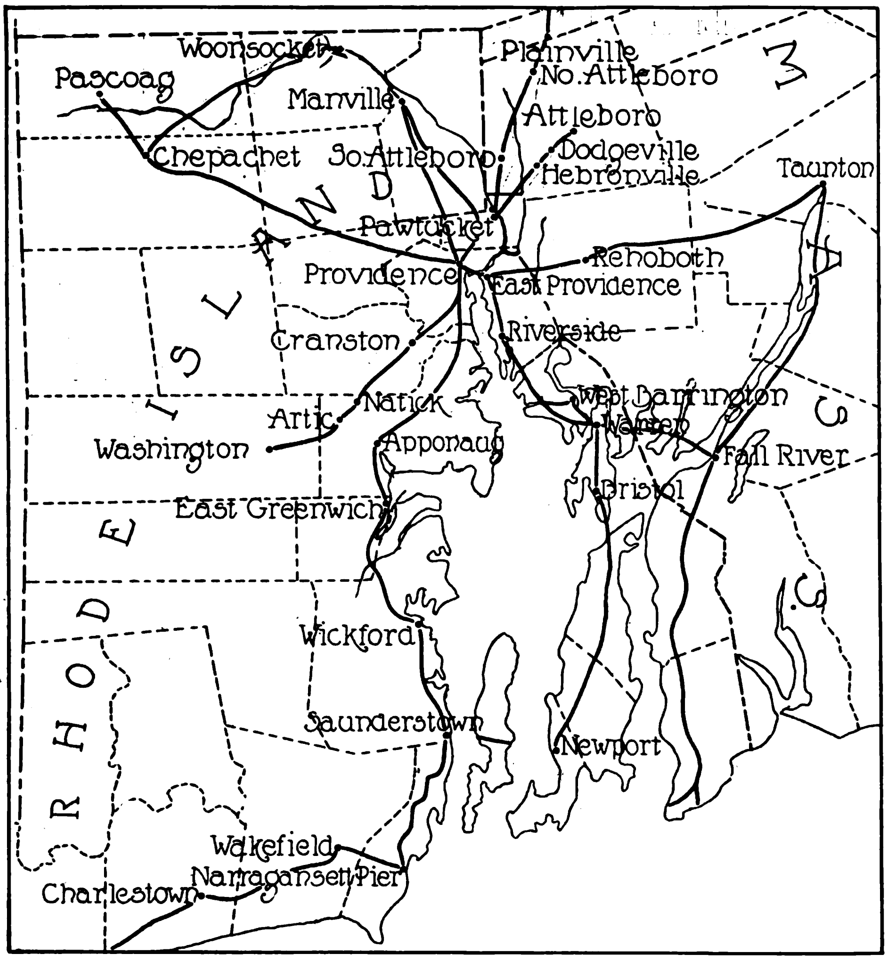
Providence is the commercial centre of Rhode Island, eastern Connecticut and central and southwestern Massachusetts. In this territory is a population of approximately 750,000. The line of demarcation may be said to be drawn to include the city of New Bedford at the southeast, and this line carried northeast will include the towns of Dartmouth and Eastport, the city of Fall River, the towns of Freetown and Berkley, the city of Taunton, the towns of Dighton, Swansea, Rehoboth, Norton, Attleboro, North Attleboro and Plainville, and another line carried west would take in the Massachusetts towns of Wrentham, Bellingham, Blackstone, Uxbridge and Douglas. From this point south the line will take in a section of Connecticut about 15 miles wide.

From Providence lines of railroad reach New Bedford via Taunton, Fall River, Worcester, Mass.; Pascoag, R. I.; Hartford and New London, Conn., and and Boston via Attleboro and via Wrentham, and to Newport. In addition there are trolley lines to Fall River and New Bedford, Taunton, Attleboro and North Attleboro, Blackstone, Danielson, Newport and Narragansett Pier. There is a network of transportation lines from practically every locality within the state and to central and southeastern Massachusetts, and one trolley line and two railroads into Connecticut.

The following tabulation gives the population of the towns and cities that may be considered as accessible from Providence by delivery and where the trade is sufficient to justify distribution, Providence having

by close estimates about 240,000 inhabitants.

North	
Pawtucket	55,000
Central Falls	27,000
Cumberland	11,000
Lincoln	10,000
Woonsocket	40,000
North Providence	6,000
Northeast	
Plainville	5,000
North Attleboro	10,000
Attleboro	18,000
East	
East Providence	17,000
Seekonk	4,000
Rehoboth	3,000
Southeast	
Fall River	125,000
New Bedford	100,000
South (East Shore)	
Barrington	3,000
Warren	7,000
Bristol	9,000
Portsmouth	3,000
Middletown	3,000
Newport	30,000
South (West Shore)	
Cranston	25,000
Warwick	20,000
West Warwick	10,000
East Greenwich	4,000
Coventry	6,000
North Kingstown	4,500
South Kingstown	6,000
West	
Johnston	6,000
Scituate	4,000
Foster	1,500
Northwest	
Smithfield	3,000
Gloucester	1,500



Map of the Greater Part of Rhode Island and Eastern Massachusetts, Showing the Location of the Principal Towns and Cities Reached by the Delivery Services of the Large Stores of Providence.

Going in the directions indicated the mileages to the different cities and villages on the main lines of travel are as follows, starting from Providence:

North		
Pawtucket	4.1	
Lonsdale	2.7	6.8
Ashton	2.4	9.2
Manville	4.0	13.2
Woonsocket	3.3	16.5
Northeast		
Pawtucket	4.6	
S. Attleboro	2.7	7.3
N. Attleboro	5.3	12.6
Plainville	1.8	14.4
Pawtucket	4.6	
Hebronville	3.0	7.6
Dodgeville	3.0	9.6
Attleboro	2.1	12.7
East		
East Providence	2.6	
Rehoboth	5.3	8.9
Taunton	9.7	18.6
Southeast		
Warren	11.6	
Fall River	20.2	
New Bedford	33.8	
South (East Shore)		
East Providence	2.6	
Barrington	7.7	10.3
Warren	1.6	11.9
Bristol	4.2	16.1
Newport	12.1	28.2
South (West Shore)		
Cranston	4.0	
Pawtuxet	1.5	5.5
Apponaug	4.3	9.8
East Greenwich	2.8	12.6
Wickford	7.2	19.8
Hamilton	1.8	21.6
Saunderstown	3.3	24.9
Narragansett Pier	6.8	31.7
Southwest		
Auburn	4.0	
Pontiac	3.2	7.2
Westcott	2.1	9.3
River Point	0.9	10.2
Arctic	0.8	11.0
Washington	2.6	13.6
Coventry	4.0	17.6
Northwest		
Centerdale	4.9	
Greenville	3.5	8.4
Harmony	2.5	10.9
Chepachet	4.5	15.4

Reference to the first tabulation will give the name of the towns and cities, beginning with those nearest to Providence, and the second gives the names of the different cities and villages on the main highways, but this does not include very many village or locality designations that may be included within these towns and cities that are very generally recognized.

Rhode Island is the most densely populated state of the nation and the greater part of its 550,000 inhabitants are in six cities and six towns, less than 10 per cent. of the population being in the remaining 27 towns. The western half of the state is really sparsely inhabited, and aside from Newport and the town of Westerly, the greater part of the population is within a radius of 20 miles from Providence. From the Massachusetts line south through the Blackstone river valley and on either side of Narragansett bay, and in the Pawtuxet river valley, the cities and towns are so close that there is hardly a line of demarcation between them. This 20-mile radius will extend over the Massachusetts line and include the towns of Seekonk, Attleboro, North Attleboro and Plainville, and it will reach the boundary of Fall River.

Either shore of Narragansett bay is practically populated by summer colonies, and in these towns a considerable number of people have country homes, where they reside throughout the year. From early spring until well into the autumn the number of residents is largely increased. But the patronage of those who have suburban homes is sufficient to justify the maintenance of daily delivery by some of the large business houses of Providence.

As might be assumed the most regular delivery is by the large department stores of Providence, of which there are four, while two of the principal groceries have services that are even more regular, because supplies of food are absolutely essential and must be delivered promptly because of the perishable character of a considerable portion of the orders.

From the viewpoint of the student of transportation conditions in Rhode Island there is wide va-

riance with those obtaining in Boston. There are in the state 80 different express services, including the Electric Express, the Adams Express Company, the Boston, Providence & Fall River Express and the New York & Springfield Express. Of the 76 companies or services 41 are located in Providence, 10 in Pawtucket, five in Newport, three in Narragansett Pier, one each in Woonsocket and Wickford, two each in Warwick Neck and Warren, three in the Pawtuxet Valley, one in North Attleboro and seven in Attleboro. Some of these companies do general contract haulage and others have regular services between Providence and some of the towns and cities. As a rule, however, comparatively little work is done by these companies for the stores of large size, but a considerable volume of transportation is done by them for the numerous manufactories.

There is practically little system so far as the express service is concerned. The majority of the companies have offices where orders may be given by telephone, and in several instances have stations where goods may be received, but the greater number serve regular customers and make calls for collection and delivery. Some of the companies have times of departure, fixed for the convenience of the customers, but no attempt is made at systematic service, as provided by Boston transportation concerns.

There is a greater number of houses that make their own deliveries than there is in Boston, in proportion to the business done. Of these the department stores and the furniture dealers will deliver anywhere in New England, provided the order is of sufficient size to warrant this expense. All of the department stores utilize motor vehicles and the use of these has practically eliminated the service of the express companies, and it has made possible regular deliveries in a much greater radius than ever before. Not only has the expense per package been lessened materially, but direct dealing with the customers has given a much greater degree of satisfaction. By this is meant that the stores have control of their own men and equipment, which they did not have with contract delivery, and in the event of loss the cause is easier to trace and the adjustments can be made much more satisfactorily.

The Outlet company, which has a very large store, does not deal in meats, groceries or food products, but handles all kinds of dry goods, men's and women's apparel, house furnishings, furniture, etc. The company's store is practically all of the square bounded by Weybosset, Eddy, Pine and Garnet streets. Weybosset street is the widest business thoroughfare of the city and the other streets are comparatively narrow. This company is just completing a new building that will have 75,000 square feet of floor space, which it has not as yet occupied, and it is planning extensive changes that will probably be completed before the end of the year.

This company is especially favored in the fact that a larger proportion of the sales are taken from the store by the purchasers than is the experience of the other stores, and this minimizes the requirements as to delivery equipment. The company now has in service 12 Autocar delivery wagons of 3000 pounds capacity, two of which are fitted with furniture bodies; two Ford chassis fitted with tops and express bodies, and five horse wagons. This makes a total of 19 vehicles in regular use, while there is also a specially equipped wagon that is used for the delivery of gas and coal ranges, etc. Horse equipment was used exclusively until December, 1909, when the first motor wagon, an Autocar, was purchased, and this was utilized in

Sorting the Packages and "Stacking" the Motor Wagons for the Shepard Company in Washington Street, Providence, R. I., in Preparation for the Suburban Delivery.

suburban delivery. The company had not until that time sought to make deliveries outside of Providence, Pawtucket and Edgewood, but this was the beginning of an era of delivery expansion and improvement, and the development of a decidedly superior service.

The work accomplished was what would have hardly been done with horses, and it would be impractical to make direct comparison with animals. Later on other machines were purchased and the number of horse wagons reduced, the purpose being to improve the delivery outside of the compact portion of Providence; working the horses where they could be used to the best advantage they were found to be more economical.

A word of explanation relative to the topography of Providence may be interpolated. The East Side, so-called, is a tongue of land extending south between the Blackstone river on the east and the Providence and Moshassuck rivers on the west, from the Paw-

tucket line. This tongue has a ridge close to the west side that rises at its extreme to a height of 210 feet. The streets run generally north and south and east and west, and the ascents from the west side are very steep, in some instance the grades being 15 feet in 100. The south end of this ridge is known as College Hill, and the northern portion Constitution hill. The West Side of the city is much the larger and it is encircled by Smith, Fruit, Federal, Constitution and Willard's hills and Mount Pleasant, the last named being the highest. Aside from Mount Pleasant the grades are not what may be regarded as heavy. These hills are in reality heights, and when ascended the highways are comparatively level. The streets of Providence are excellent, there being granite block paving in many of those where there is heavy traffic, with asphalt and macadam in the greater part of the residential thoroughfares. There are some gravel streets and some that are not improved.

Outside of Providence, in practically every direction, there are no heavy grades, and in the different

The Delivery Wagons of the Shepard Company in Clemence Street, Showing the Conditions of This Highway for Loading and Starting.

towns and cities the streets are generally very good, while the main or connecting highways, in which there is the greatest volume of traffic, are excellent. In the towns of the state highways are well maintained and these may be said to be better than the average state road outside of Rhode Island.

The motor delivery equipment of the Outlet Company is now kept at the service station of the Autocar Company in Pearl street, approximately three-quarters of a mile from the store. It is under the supervision of a practical mechanic who sees that the machines are maintained to the required standard. The company pays a regular service charge and beyond this maintenance is paid for whatever work is performed, this varying with requirements. The regular oiling, greasing and adjusting of the machines is done at the garage under the direction of the superintendent of the equipment, but the drivers are expected to fill the fuel and oil tanks and the radiators. This is practically all the attention they are required to give. The machines leave the garage mornings at 7:30 and are expected to reach the store at 7:45, and there the loading is in Pine street, all of the packages being taken from the shipping department through a small court from the rear of the main store building.

The suburban wagons are first loaded, or at least these have a right of way, and for this suburban work five machines are utilized. The first delivery is started about 8:30. The five suburban Autocars make one trip a day and the load as a rule is heavy. One of these takes in East Providence, Barrington, Warren and Bristol, as well as Seekonk, reaching the localities known as East Providence Center, Phillipsdale, Rumford, Kettle Point, Bay View, Boyden Heights, Silver Spring, Riverside, Camp White, Narragansett Terrace, Drownville, West Barrington, Nayatt, Barrington, Hampden Meadows, Warren, South Warren, Beach Terrace, Bristol Highland, Bristol and Bristol Neck. This is the East Shore route.

The West Shore route begins practically at the city line and goes south, reaching Palace Garden, Spring Green, Hoxsie, Cole's, Riverdale, Conimicut, Shawomet, Riverview, Long Meadow, Grant's, Highland Beach, Tiffany, Rocky Point, Oakland Beach, Buttonwoods, Apponaug, Hillsgrove, Lincoln Park, Norwood, Greenwood, Coweset, Chipiwanoxet and East Greenwich. A third route goes southwest and through the Pawtuxet valley, reaching Knightsville, Meshanticut Park, Oaklawn, Sockanosset, Howard, Pettaconsett, Pontiac, Natick, Westcott, River Point, Clyde, Lippitt, Phenis, Harris, Arkwright, Fiskville, Hope, Arctic, Centerville, Jackson, Crompton, Quidnick, Bakersville, Anthony and Washington.

The fourth route goes west and reaches Manton, Lymanville, Centerdale, Graystone, Esmond, Georgiaville, Stillwater, North Providence, Fairlawn in the city of Pawtucket, Saylesville, Prospect Hill and West Lonsdale in the town of Lincoln, and Berkeley and Ashton in the town of Cumberland. The fifth route is north and east and reaches all of Pawtucket except Fairlawn, Central Falls, Valley Falls, East Lonsdale, St. Jean, South Attleboro, Hebronville, Dodgeville, Attleboro Falls, North Attleboro, Plainville.

Considering this service it will be understood that it extends outward 16 miles on the East Shore route, 13 miles on the West Shore route, 14 miles on the Pawtuxet valley route, 10 miles on the west and northern route, and 15 miles on the Attleboro route. These are covered once daily and the distances driven will average from 65 to 70 miles. Of the other machines, one is reserved for special service, two are given over to furniture delivery, three are used for making regular city delivery, making three trips, and one covers Edgewood, Pawtuxet, Pawtuxet Neck, Lakewood, South Auburn and Auburn, making two trips. This will account for the 12 Autocars. Aside from the regular suburban service the delivery in Pawtuxet requires a mileage of about 50, and the three machines used in the city will make an average of about 16 miles each of the three trips. Besides the motor vehicles three

horse wagons are used in the central section of the city where the deliveries are numerous and the stops close together.

Up to four years ago the delivery of this store with its own equipment was practically within the city and Pawtucket, and at most was within a radius of four miles. Of course in exceptional cases and in the event of sales of furniture deliveries were made much greater distances, but this may be applied to the regular distribution of parcels. Beyond that radius delivery was made by express companies. At that time the company used about 45 horses and from 20 to 25 wagons. In the delivery work where three trips were made daily the average driven was about 35 miles, one trip in the morning and two in the afternoon, the morning delivery being heavy and the afternoon trips comparatively lighter.

The reduction of the horse vehicles to three and the use of the motor wagons has afforded a practical and satisfactory delivery in an area that is approximately 12 times as large, and the number of express services has been reduced to two, one to Woonsocket and the other to the summer colonies between Warren and Fall River, to Fall River and to New Bedford. There is really no limit to the delivery of furniture, and an order of sufficient size will be taken 200 miles if necessary. Deliveries are frequently made up to 50 miles. The special service machine is on call for long or short trips as required, but it is used for the delivery of refrigerators in summer and for ranges and gas stoves in winter. This machine has been sent to New London in one direction and to Cambridge, Mass., in another, these being trips of 70 and 50 miles respectively.

One of the Ford wagons is equipped for the use of a shade and awning crew that carries tools and stock for practically any condition that may eventuate, and the other Ford machine is similarly equipped for a carpet-laying crew. With these the men are carried about quickly, their time is economized, and the stock is always ready without delays. The company has a wagon fitted for the delivery of stoves, gas ranges, etc.

The Autocar wagons are fitted with longitudinal seats, well cushioned, and each Friday afternoon during the summer, when the store is closed, the children of all the orphanages in Providence and vicinity are taken for an outing as the guests of the company. The drivers, who have to drive the wagons, and lose their half holiday, are paid double time for their work. Arrangements are made to visit each orphanage in turn, with the number of machines that may be needed, and the children and their attendants are taken out sometimes 20 miles to a point where they can have a feast of ice cream, cake, candy, etc., the refreshments being carried in a car. The plan is to give them three hours on the road and a half hour to an hour at the outward end of the journey.

Members of the company say that the motor wagons have sufficiently proven their utility and economy for all kinds of suburban work, and for portions of the city where the grades are steep. In fact, it is the intention of the company to dispose of all its horses and it is probable that within a year the delivery equipment will be completely motorized. They believe that electric delivery wagons will better serve the purposes of the company in the portions of the city where the routes are comparatively short and the stops are frequent because of the ease of stopping and starting. They favor their use where a package must be delivered every one and a half or two minutes, because of the need of cranking the gasoline machine or wasting fuel through constantly using the motor. They point out the fact that the company has very widely increased the area from which its patronage is drawn, and believe that the radius limit may be increased as the necessities of the service demand.

Three of the Four Autocars Operated by L. Dimond & Sons Co., Inc., in Suburban Delivery, Covering a Radius of Approximately 15 Miles from Providence.

The company has just begun the demolition of buildings in Pine street, where a seven-story structure is to be erected with frontage of 133 feet. This will have a court, in the centre, in which the wagons can be loaded, practically the entire equipment at one time, and the machines can be driven in from Pine street and out on to Eddy street. This building will have a combination gasoline and electric garage on the ground floor, as well as the shipping department, while the packing rooms will be on the second floor. The remainder of the building will be devoted to storage and to a furniture workshop, the shop to be on the second floor. This building will be a model and it is expected that the shipping department will be the equal, if not the superior, of any in the country, especially with reference to handling the goods and load-

ing the wagons. The drivers will be off the street, where there can be no interference from traffic, where they can work protected from the storms, and where the goods cannot be damaged by rain.

This shipping department will be sufficiently large to provide for future increase of business, and it will be fitted with the finest equipment that can be obtained. This will make practical the realization of the fullest economy of the machines, for there will be no reason for the delays that are now resultant from sidewalk loading and from shipping room congestion. The garage incorporated with the building will eliminate all delays that are now experienced in the event of a change of machines being necessary, and it is purposed to have facilities that will be ample for at least doubling the number of machines. The management says that the motor vehicles are the logical delivery equipment for the Outlet store, and while they have not as yet a compilation of figures that will actually represent the cost of delivery by the machines, the expansion of the business has been successfully brought about, which is in itself a very large progression. The exact cost per year is being worked out, but the combination service has made this work complex. The cost of tires, however, has been determined to be a slight fraction more than three-quarters of a cent a mile for each machine, which is regarded as being very low.

The Loading Gallery and Chutes of the Providence Public Market in Snow Street, the Baskets Descending from the Second Story to the Wagons by Gravity.

The company has a superintendent of the delivery equipment, and he is expected to have the machines ready for use and to meet every exigency that may arise where they are in use. He dispatches the machines in the morning from the service station and he sees them all reach the garage at night. He attends to all mechanical needs and supervises all repairs and adjustments. He is responsible for the condition of the equipment. From time to time he drives about in a car and observes the manner in which the drivers handle their wagons, and this insures against abuse and carelessness. During the summer season the machines are each withdrawn from service and overhauled and painted, so that by Labor Day of each year the equipment is ready for a long period of hard work. Incidentally the company places high value on the advertising qualities of the equipment and the wagons are very well kept. The delivery of the company will range from 2500 to 7000 packages a day, according to the season of the year, exclusive of furniture and the larger and bulkier house furnishings, and some drivers will sometimes deliver as high as 300 packages a day. The regular deliveries are at 8:30, 1 and 4 o'clock each day but Fridays and Saturdays. But one delivery is made Fridays during July and August, and Saturdays the hours are 9, 2 and 5:30. Under ordinary circumstances the drivers are at the garage by 7 in the evening save Saturday, when 8 to 8:30 is an approximate average. Each driver has a helper, and these are active boys who can cover ground quickly and do a great deal of the "shacking," the driver usually delivering close to the machines.

Shepard Company's Service.

The Shepard Company, which has a very large department store in Providence, is controlled by John Shepard, Jr., who is also the treasurer and executive of the Shepard, Norwell Company of Boston, Mass. This concern occupies a building that is surrounded by Westminster, Union, Washington and Clemence streets, and while the greater part of the ground floor is given over to dry goods, men's wear, and a number of the sections of such stores, no inconsiderable part of the Washington street end is given over to departments for dairy products, groceries and fruit, and in the basement is a large market.

The Shepard Company is the pioneer of the country and perhaps of the world in the use of power wagons for delivery. In the winter of 1894-5 Mr. Shepard had an express wagon fitted with a steam power plant, and proposed to use it for delivery purposes. In experiments it was found impracticable because the wagon would not endure under the heavy stresses, and good traction could not be obtained with narrow steel tires on wet or muddy streets. The following winter Mr. Shepard had a gasoline engine designed for a specially built chassis. Both equipments were constructed by the George Cruickshank Engine Company, Providence, R. I., from designs by L. F. N. Baldwin, who was later widely known as a racing driver of steam cars. This wagon was fitted with a body in-

tended for carrying furniture that was built in the West, which had capacity for 20 bedsteads. This wagon had steel tires and there was difficulty in obtaining traction if the streets were wet or muddy. The engine had 20 horsepower and was a two-cylinder double-impulse motor with hot tube ignition, and the drive was by chain and by belt. The drive from the jackshaft to the rear wheels was by chain of the link and clamp type then used extensively for agricultural machinery, but the chain would not endure under stresses. This machine was fitted with a car fender. It was exhibited extensively during 1896, but it was not practical because of the reasons stated.

Later on Mr. Shepard experimented with both gasoline and electric wagons very extensively. The electric machines were not well built and one of the first was weighted with an extremely heavy body, so that its mileage was comparatively small. As a matter of fact none of the vehicles tried, and they were worked for considerable periods, gave such results as would justify abandoning horses, but it is fair to assume that had they been carefully and systematically operated they might have been more satisfactory. At that time the chief value was in advertising.

The market and grocery when opened required a different character of delivery than the remainder of the store, for food is usually purchased when desired, and it was necessary to increase the equipment materially. Up to December, 1911, when the first of the motor wagons now in use was purchased, from 38 to 42 animal wagons were in service, and from that time up to the end of the following February, six Autocars were purchased. These were utilized for suburban work. From August to December, 1912, 10 2000-pound and four 3000-pound G. M. C. wagons were delivered, this giving the company in all 20 machines.

The intention was when the machines had been delivered to dispense with practically all the animals, but this was not done and the greater part of the G. M. C. machines were withdrawn and the present equipment of the company consists of six Autocars, two G. M. C. wagons, a 5000-pound Lansden electric truck, and a Detroit 1000-pound electric wagon has been ordered, and a 1000-pound M & P electric wagon is now being demonstrated. Besides these the company is using from 22 to 25 horse wagons. The company handles from 3000 to 3500 baskets daily from the market, there being an average of about 20,000 a week, and the number of parcels will be approximately the same, although the largest number ever handled by the store in a single day, during a January sale, is said to have

Providence Public Market's 3000-Pound Kelly Wagon Loaded for a Daily Trip Covering the East Shore from Providence to the Northern Bristol Line.

reached 16,000. The total number of deliveries will approximate 2,000,000 annually.

The company makes delivery within a radius of approximately 15 miles of the store, exclusive of furniture, which is delivered long distances at times. The policy is within a five-mile radius to deliver groceries four times daily, parcels three times and furniture twice; within 10 miles parcels and groceries twice daily, and up to 15 miles parcels and groceries once daily. By reference to the tabulations it will be seen that this includes either side of Narragansett bay to Bristol and East Greenwich, the Pawtuxet and Blackstone valleys and the Attleboros.

The long distance deliveries leave each morning at 10 o'clock. Within the 10-mile radius the deliveries are made at 9:30 and 2:30, but the afternoon trip is made an hour later Saturdays. Within the five-mile radius the groceries are delivered at 7:30, 10:30, 1:30 and 4, with an additional trip at 6:30 Saturdays. The parcels are sent out at 10:30, 1:30 and 4, and an extra trip at 6:30 Saturdays. There is no change in this schedule throughout the year save on Fridays during July and August, when the store is closed at noon and the first afternoon trip is made at 1 o'clock and the second is omitted.

The machines and wagons that make one and two trips during the day are loaded with both parcels and groceries, but those that make three and four trips each are loaded with either parcels or groceries, there never being combination loads save in the event of emergency. The furniture deliveries are not made to schedule, the wagons being sent away as the goods are ready for shipment, but the intention is to start them as early as is practicable.

The motor wagons are generally used on the routes in the suburbs, but the Lansden electric truck is utilized for freight haulage from the railroad and shipping terminals, and to and from the warehouses. The electric machines now having demonstration are used for city delivery, and the gasoline wagons are used on the

West and East Shore routes, the Blackstone valley, the Pawtuxet valley and the Attleboro routes. The machines carry combination loads, the parcels being separated by wire gratings, and each wagon is fitted with an ice box for use in summer, in which are carried the meats, butter, cream and similarly perishable packages. The drivers of these routes take orders as well as make delivery, and the start is made at 10 daily to allow time for making up the packages from the slips turned in by the drivers when they arrive. Saturdays the loads are usually very large and it is necessary to have two ice boxes to preserve the orders that might be damaged by the heat in transit.

While the suburban routes have unusually heavy delivery throughout the summer months, the work is such that there is no change made in them at other seasons and the same areas are covered throughout the year. But with the lessening of the work for the suburban wagons in autumn the city delivery increases. But there is annually a general increase in the business carried on in the city and its suburbs.

The West Shore Machine, a 3.5-Ton Frayer-Miller (Kelly) Truck, Loaded with 401 Baskets for the Providence Public Market's Distributing Station at East Greenwich.

The traffic is very heavy in Westminster and Washington streets, and no vehicles are permitted to stand in the former, it being a one-way thoroughfare during the business hours of the day. Traffic can move through Union street toward Washington and through Clemence street in the same direction. Washington street is two-way, and for this reason is generally filled with traffic. The loading at this store is done in Washington and Clemence streets, and in the latter it is necessary to keep one line of wagons only, for the roadway must be free for the passage of fire apparatus in the event of need. As the roadway is not more than 15 feet, and the sidewalks are just wide enough for a single pedestrian, it will be seen that loading in Clemence street is accomplished under difficulties at all times. In this street the parcel wagons are generally loaded, but the grocery and the combination wagons are "stacked" in Washington street.

All the packages from the market are brought to the street floor on elevators and taken to the sidewalk, where they are sorted and packed in the wagons, and the parcels are similarly brought to the Clemence street sidewalk by an elevator and brought to Washington street and sorted and packed. Clemence street extends from Washington street to Fountain street, and into this the wagons of the company are drawn while waiting, for nine or 10 are practically all that can be handled in the street beside the store, and six wagons and machines is about the limit for the Washington street end of the building. Besides, the furniture must be loaded from the Clemence street side. There are two elevators for the grocery and market, two for the furniture, and one each for the parcels and dry goods. Because of the narrow walks in Clemence street the wagons must be a sufficient distance apart so the carriers can be placed in the roadway behind them, and because Washington street is so much travelled the carriers are seldom used, the packages being brought to the wagons in the arms of the drivers and helpers.

The loading at this store is accomplished under conditions that necessarily require a great deal of time, and there appears to be no practical way of making any change for the better because of the practically prohibitive price of land and the great cost of a sufficient area to establish a loading station on private property. The Autocars are kept at the service station of the Autocar Company and the other machines are kept at the garage of the Shepard Company, which is close to the stable, both garage and stable being under the supervision of the superintendent of the shipping, Robert Gibbons. Each driver has a helper, it being the custom of the company to develop the drivers from the helpers, and the men report at the store from 7:30 to 9 in the morning. The expectation is to finish the last trips for the day by 7 o'clock at night, but often the suburban drivers finish later during the summer months. The company will send special deliveries when required, the last of these being sent away when the store closes for the night. Under some circumstances some of the wagons are loaded when they return from the last trip and are sent to the garage, the start being made early in the morning, this plan gaining a couple of hours that might otherwise be lost in loading in the morning.

The experience of this store is that with the machines the deliveries can be more quickly made in the suburban sections, and a greater degree of satisfaction gained for the customers. The area covered with the machines is not greater than with animals, but it is served more expeditiously and, in all probability, more economically. The intention of the company is to use

the gasoline machines for its suburban work and if the electric wagons are proven economical in practise they will be used on the routes closer to the store, and possibly on some of the main city work.

The Dimond Store Service.

The store of L. Dimond & Sons Co., Inc., is in three buildings, the first between Westminster and Middle streets, with Union street at one side, the second between Middle and Weybosset streets, and the third between Middle and Weybosset, with Eddy street at one side. The first and second buildings are connected by a subway and by foot passages over Middle street from the second, third, fourth and fifth floors. This concern handles all kinds of dry goods, house furnishings and groceries, dairy and general food products. It is the smallest of the large department stores of Providence and it sends out an average of 35,000 parcels a month, exclusive of the deliveries from the grocery and market departments. The company has in the service of the stores four Autocars and 12 wagons, and five wagons are utilized for the food delivery.

The policy of this company is to use its motor wagons in its suburban work, and to deliver in the city with the wagons. This plan has made it possible to eliminate the use of about a dozen express services that were formerly used, to serve its customers to much better advantage, and to do away with all complications arising from the indifference of the employees of other concerns. Not only this, there is a good deal of economy in this service, for the price paid per package was very large as compared with the cost of those delivered by equipment owned by the store.

The shipping room of the store is in the basement of the second building and the packages are brought to it from the departments by elevators, and are taken through the subway from the first building. There is a single elevator from the shipping room to the sidewalk in Middle street, and here all the parcels and furniture are loaded. The loading for the market and grocery is done in Eddy street. Traffic in Eddy street during business hours is from Westminster street to Weybosset, in Union street from Weybosset to Westminister and access to Middle street is through Union from Weybosset, a two-way street. The Dimond wagons and machines enter Middle street from Union and after loading are driven out through Eddy street. Middle street is about 15 feet wide, with 30-inch sidewalks, and as the store controls the greater part of the property at either side it is permitted to use it with practically no limitations. There is an entrance to the store at either side directly under the galleries by which the two buildings are connected.

Because of the need of the customers having access to the two buildings on the ground floor it is not practical to use all of the street, and the space available, after the requirements for carriers and handling have been provided for, will suffice for 10 vehicles. So it will be seen that it is not possible to load more than half the equipment at a time. The average delivery wagon will hold about 1000 pounds of the general run of goods and packages, but the bodies of the motor wagons will take approximately three times as much, so that in putting on a full load more time is required.

The Dimond Company has made no change in its city delivery with the use of motor wagons, for it now uses the same number it has for a considerable length of time, but the addition of the four machines has made it possible to better serve its customers and over the same area that is covered by the delivery service of the other two stores. One Autocar is sent over the East Shore route daily as far south as Bristol, another

Loading the Motor and Horse Wagons for the R. L. Rose Company, the Animal Vehicles for the City Delivery and the Machines for the Suburbs.

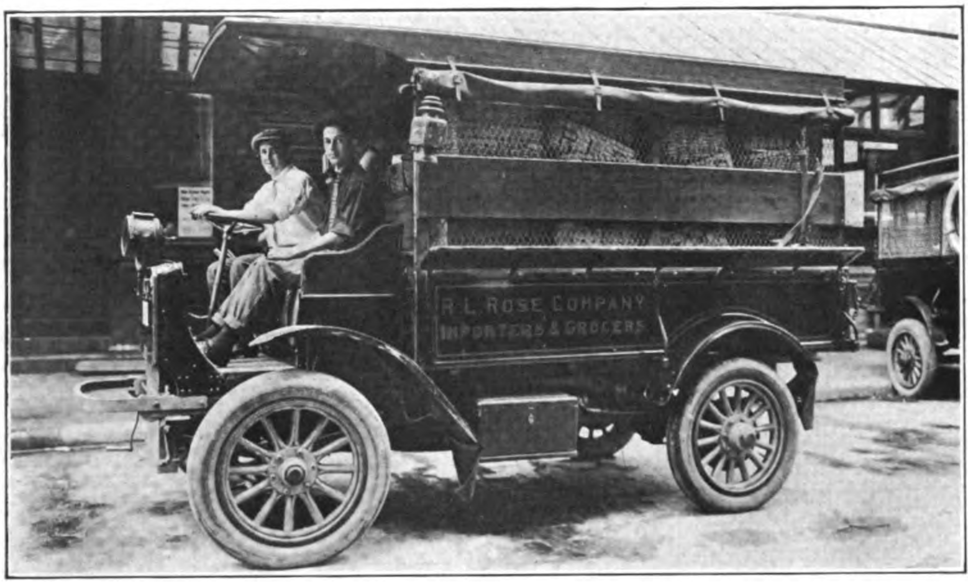
is sent over the West Shore route daily, covering all of the localities between Providence and East Greenwich, and a third goes to the Pawtuxet valley three times a week and to the Attleboros every alternate day. The fourth is sent west to Centerdale and vicinity daily, and in addition is used in the delivery of furniture.

Three deliveries are made daily, at 8, 1 and 4 o'clock, save Friday during July and August, when the second afternoon trip is omitted. The Saturday morning delivery is made at 9 when the store is closed Friday afternoon. The wagons have a driver and a helper as a crew. The machines are kept at the service station of the Autocar Company and the wagons at the company's stable. While the company has the use of Middle street by sufferance and there is no reason to believe that this use cannot continue, there is a great deal of time required for the loading, and there is no possibility of eliminating this waste. It might be practical to provide more elevators, but the packages

must be carried along the street to the wagons, sorted and arranged for delivery, and there would be no appreciable gain in the time necessary for making ready for the start. Assumedly, the drivers work conscientiously on the routes and so the only chance for gain would seemingly be in handling at the store.

Providence Public Market Delivery.

What is regarded as the largest business enterprise of the kind in America, and perhaps in the world, is the Providence Public Market, which occupies a large building surrounded by Westminster, Snow and Chapel streets and a driveway from Chapel to Westminster street. This concern has three other large stores in Providence and a branch at Worcester, Mass., that is about two-thirds as large as the main store at Providence. Besides dealing in groceries, meats, dairy products, vegetables, fruits, fish and staple and special food, it has its own bakery in the same building. The concern is credited with doing upwards of a $6,000,000 business annually, and it is noted that the patronage has increased consistently each year.



The "West Shore" Motor Wagon of the R. L. Rose Company, Starting with Its Morning Load for the North Section of the Route.

This concern has the largest delivery service connected with its main store in Providence of any concern in New England, it using regularly 70 single wagons and 10 additional wagons Saturdays, as well as a three-ton Frayer-Miller truck and two 3000-pound Kelly machines, and several two-horse teams and trucks. The delivery of this concern is within a smaller radius than is covered by the department stores, extending to the Pawtucket line on the north, through East Providence, Barrington and Warren to Bristol, south for about 10 miles along the West Shore, and west about six miles. In the city four deliveries are made daily, at 7, 9:30, 1 and 4 o'clock, but where there are two deliveries daily these are at 7 in the morning and 1 in the afternoon. The company has from 135 to 140 horses in use constantly.

Three years ago the company purchased its first machine, the Frayer-Miller truck, and this was for use primarily in transfer service. The company had a distributing station at Shawomet Beach, where horses and four wagons were kept, and the goods for delivery in this section were hauled over the road early each morning and were delivered at the station, where the baskets, already made up, were transferred to the single horse wagons and carried out. This service was found to be a material saving, but it was believed that there was economy in a motor truck. This work was constant throughout the year, but during the summer months the loads were often more than could be sent with one vehicle. The company has a contract with a man who superintends the delivery from Shawomet and two of the drivers live there, the other two living at Providence.

The truck was used for this transfer, loading at the store at 2 in the morning, and making the drive of about 11 miles, arriving at 5:30 to 6. From this point the delivery was begun at 7 o'clock. As much of the load as could be taken was placed in the wagons and the remainder left at the station and the truck returned to Providence. The remainder of the day it was used for hauling freight from the railroad and shipping terminals and the warehouses. With the increase of business during the summer it was often necessary to send a wagon with a load as well, for it was found that when the machine was filled and all the baskets packed on it that could be carried much time was lost in loading and handling.

In the delivery from Shawomet all the wagons are provided with ice boxes for the packages of perishable goods, for the routes are long and the time required for covering them necessitates care in handling. The drivers take orders on these routes, and these are sent to the store and delivered by the drivers, so they are ready for sending out in the morning. As these orders are made up during the afternoon and early evening they are kept in refrigerating rooms until loaded in the morning. In the hot weather rapidity in handling between the store and the distributing station is a factor of some importance. Previous to this year the Frayer-Miller truck was the only machine in service, the other routes being served by horse wagons, but this spring two Kelly 3000-pound wagons were added to the equipment, and one of these is used to serve the customers in the lower section of East Providence, reaching Riverside, Narragansett Terrace, Drownville, Barrington, Nayatt, Hampden Meadows, Warren and South Warren in the morning, and going as far as Riverside in the afternoon.

The other Kelly machine is used to make deliveries in Edgewood, Pawtuxet, Pawtuxet Neck, Dryden Heights, Spring Green and Lakewood. The East

Providence route is known as the East Shore, and the Edgewood-Lakewood route as the West Shore, the former going outward about 12 miles and covering approximately 50 miles daily, while the West Shore route will, for the two trips, reach 40 miles or better. Instead of sending horse wagons to Shawomet with the baskets the larger truck cannot carry, the West Shore machine very often makes an early morning trip and then is driven back to cover its regular work.

There is one delivery a day from Shawomet, each wagon covering two routes; there are two deliveries daily to Riverside and one delivery south of that for the East Shore route; two deliveries daily for the West Shore route; two deliveries daily to Auburn; one delivery daily to Norwood, Centerdale and Rumford; three deliveries a week to Oaklawn and once a week to Hillsgrove and to Seekonk.

For the transfer work and the suburban routes the machines have thus far given satisfaction, and it is believed that there will be even better results with longer experience, but the members of the company are as yet of the opinion that motor equipment is not practical for city delivery. The company does not deliver from any of the branch stores in Providence, and it is estimated that about half of the purchases are taken away by the customers. But with this reduction about 30,000 baskets are taken out each week, of which about 7000 are delivered Fridays and about 9000 Saturdays.

Handling the baskets is done with speed and care. All the packages are sent by belt conveyors from the different sales departments on the first floor to the shipping room on the second floor. Here they are sorted for number and are then distributed into numbered trays, conveyors carrying some of them to different parts of the room. From the trays they are checked into the baskets, and if there is to be a wait of such a length that the goods might be affected the baskets are placed in refrigerating rooms until the drivers report. There are seven inclined chutes from the shipping room and the wagons are backed under these and the baskets sent down in very quick time, the drivers arranging them as they receive them. There are two entrances that can also be utilized for loading or receiving. When the wagons return the empty baskets are sent to the shipping room by a conveyor. The fact that 80 wagons can be loaded four times daily in a street with a 15-foot roadway and a three-foot sidewalk, and a 10-foot alley, without congestion or confusion, shows that the delivery has been splendidly systematized. The chutes descend from galleries on the side of the building, and permanent canopies protect the wagons during the loading. Most of the newer wagons have tops, but the older ones are open.

R. L. Rose Company's Delivery.

The R. L. Rose Company is the largest high-class grocer in Rhode Island, having its main store in a building extending from Weybosset to Pine street, with Hay street at one side of the structure, a branch store in Westminster street, and another in Pawtucket. The company does its principal volume of business from the main store and only delivers from this, but there is a separate delivery equipment for the Pawtucket store. The company's business from the main store may be said to extend from the Pawtucket line south to Bristol and Fall River on the east side of Narragansett bay, and to Westerly on the west side. In the delivery in and about Providence 15 single horse wagons and three Autocars are used.

During the summer when the business is somewhat lighter in the city one of the Autocars makes daily trips to Narragansett Pier, a distance of 33 miles, making delivery south of East Greenwich, but taking the bulk of its load to the pier. Often more than the machine can carry is to be sent out, and this is shipped by electric express and is delivered by the motor wagon before it returns.

One Autocar is used on the West Shore route, this delivering as far south as Shawomet, Warwick Neck, Oakland Beach and the different localities in that section each day, and going to Apponaug and East Greenwich Saturdays. The third machine covers the East Shore as far south as Nayatt and Warren, making this trip in the afternoon and delivering in the Smith hill and Mount Pleasant sections of the city during the morning.

This is the summer arrangement for the machines, and during this time the work in the city is generally at its lowest ebb. The deliveries by horse wagon in the city vary from one to five, according to the locality, but there are usually 15 wagons busy, the horses being worked a half day each and making an average of about 15 miles a day. During the remainder of the year one Autocar is used in making three trips daily, covering South Providence, Edgewood, Pawtuxet and Lakewood, some portions of this section being reached twice. Generally another machine is worked with this one late in the afternoon. A second machine has a route that is as far west as Graystone and Centerdale, and this covers East Providence on a second trip. The third machine covers the north section of the East Side of Providence, Smith hill, Mount Pleasant, Johnston and Auburn, practically reaching the outskirts of the city, and this is also worked to help serve the Lakewood machine.

The work of the motor wagons has been very satisfactory in all suburban service, for they are driven from 50 to 60 miles a day, and with them it is possible to give the customers attention that would not be practical without a considerable number of animals and wagons. Not only this, but there is a decided saving in the Narragansett Pier delivery, which was formerly sent by electric express and taken out by wagons. This machine is driven from 80 to 95 miles each day. So economical has this service been found that this summer the company seriously considered sending loads to Watch Hill, which would require a drive of from 125 to 140 miles a day, but this was abandoned for a time. Now the goods are sent to Westerly by railroad and taken to Watch Hill by wagon.

The company is not yet convinced that it would be economical to use motor wagons for city delivery, but it is probable that there will be careful experiment made to determine the relative costs of motor and animal service.

GOODYEAR SERVICE STATIONS.

Tire Maker Establishes Chain of Plants to Economize Time for Truck Owners.

The Goodyear Tire & Rubber Company, Akron, O., has established truck service stations in a number of the large cities of the country, and these will be added to from time to time as conditions justify. These include garages and wheel shops that are open day and night with complements of expert wheelwrights and mechanics to meet any requirement and with facilities to perform any work that may be needed. The stockrooms are supplied with everything necessary for wheel repair and tire repair or exchange, such as wheels, rim bands, bolts, fastenings for every type of truck, and material that may be worked. The purpose of the night force of men is that the owner may place his machine in the garage at night and have it ready for use the following morning. This policy was adopted because serious interruption of service was entailed by tire renewals, especially where the work was necessarily sent to another city.

The Wood-Working Machines Used in the Wheel Shops of the Goodyear Service Stations for Fitting Wheels for Tire Installations.

It has been experienced that repair of tires, changes of wheels and exchanges of shoes frequently require considerable time unless in the hands of those who specialize in such work, this necessitating the withdrawal of the machines to the great inconvenience of business men. With a view of insuring the greatest utility of machines where tire or wheel attention is necessary and to bring about the greatest measure of economy the stations were decided on. In addition to special attention to wheels and tires the stations will undertake any other necessary work with the assurance it will be done properly and reasonably.

TRUCKS TRANSPORT RACE HORSES.

Plan Eliminates Disadvantages Attendant Upon Shipment of Animals by Railroad.

A new use was found for the motor truck when 50 trotting horses that had been racing at the Parkway Driving Club's summer meeting at Gravesend track, Brooklyn, N. Y., were loaded into padded moving vans, together with all their sulkies, clothing, boots and racing paraphernalia, and taken to the driving park in Hohokus, N. J., where the second meeting of the Metropolitan circuit was scheduled. An automobile had been used all the week in place of horses to harrow, float and brush the track for the trotters at Parkway, and when the motor vans backed up to the stable doors and took the horses on board for a quick trip to Hohokus, old time horse followers were compelled to confess that the motor machines were good for something after all.

High express rates for the transportation of race horses caused the resort to automobiles. W. H. Strang, a member of the driving club, owns a fleet of them and conceived the idea of taking the trotters from the Gravesend track to the New Jersey course. One of the advantages of the motor vans, which the horsemen appreciated, was the direct run from barn to barn. Under the old way of shipping it was necessary to hire trucks to take the animals from the race track to the railroad station and then from the station to which they were sent to the race track at that point, this involving double loading and unloading, and double charges for cartage, which the motor truck eliminated altogether. The transportation of race horses in vans is getting back to first principles. One hundred years ago, and until railroads were built, thoroughbred runners were commonly transported in horse-drawn vans in England.

One of the largest taxicab sales recorded by the White Company, Cleveland, O., in recent years, was the contract signed with the Taxicab Company of California, for 63 White machines. The purchase was a result of the service given by a fleet of 19 White taxicabs for 20 months in San Francisco, during which they were subjected to the hardest kind of treatment in a city unrivalled for the severity of taxicab operation. With the added equipment the Taxicab Company will have a completely standardized installation of 82 White machines. In addition to buying cabs, the company placed an order for five White six-cylinder, 60 horsepower, seven-passenger touring cars.

ENGLAND'S FIRST EXCLUSIVE TRUCK SHOW.

America Unrepresented Among 65 Exhibitors at Olympia---Steam Vehicles in Second Place ---Notable Lack of Electrics---Some Interesting Constructional Details Revealed.

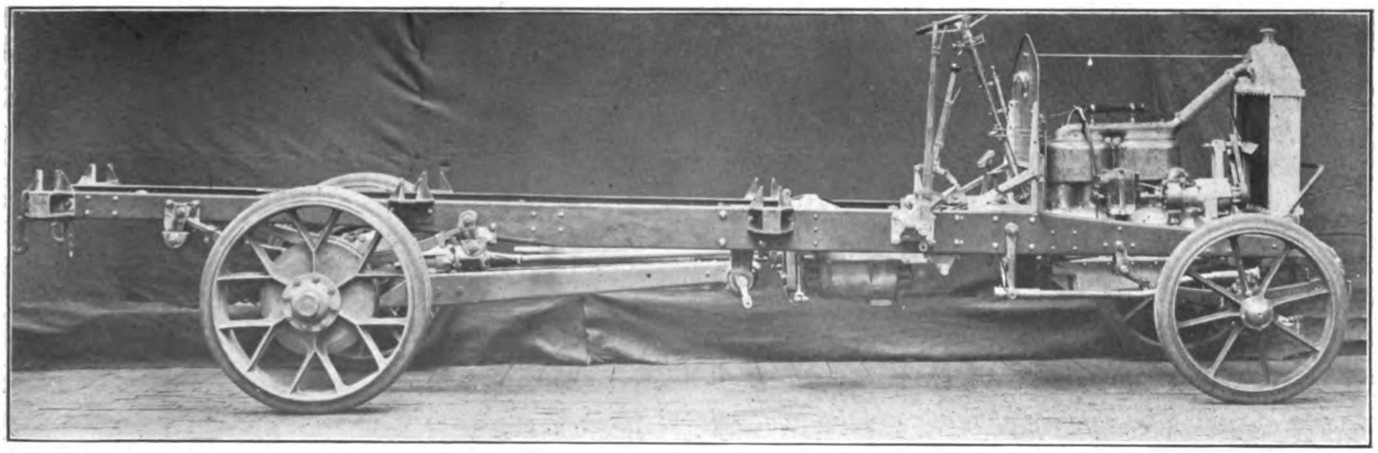
Special London Correspondence.

ALTHOUGH America has been holding commercial motor vehicle shows in New York and Chicago since 1911, and in Boston and some of the other large centres since 1912, London, England, has just experienced its first exclusive display of this character at Olympia. Four years ago, an attempt was made to hold an exhibition of self-propelled vehicles for industrial purposes, but the result was a showing mainly composed of omnibuses and cabs. Even then the list of exhibitors was so small that motor boats and marine engines were added in order to make a creditable display.

The show which opened in Olympia, July 18, was decidedly representative of the industry in Great Britain, although American manufacturers appear to have been somewhat conspicuous by their absence. Four countries, outside of England and Scotland, were included among the makers, these being France, Germany, Italy and Belgium. Of the 65 exhibitors, 53 displayed gasoline vehicles only, nine steam, two both gasoline and steam, and one gasoline-electric. Aside from the chassis and complete machines designed for strictly haulage purposes, there were a large number of char-a-bancs, taxicabs and fire and municipal service vehicles. A particular feature of the exhibit was the number of light delivery vans, although the heavy duty wagons and trucks were very much in evidence.

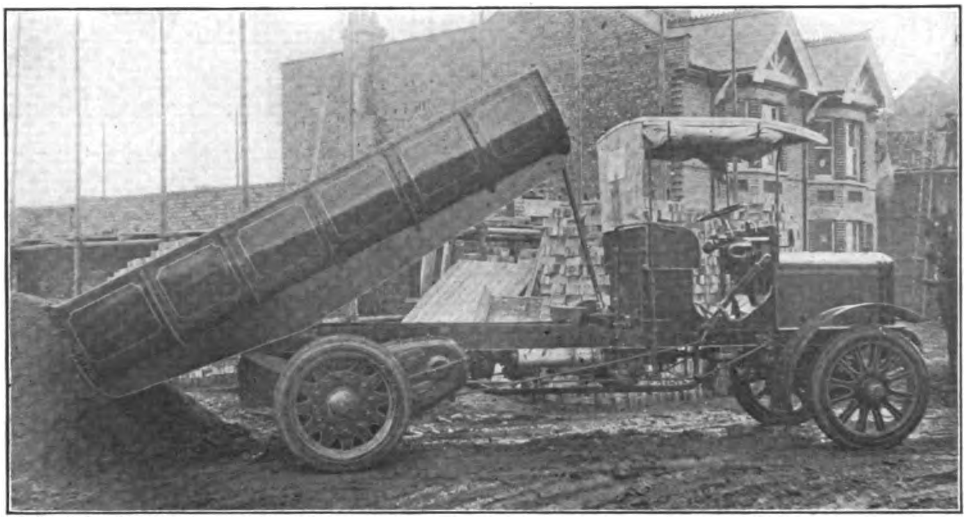
From an American viewpoint, it is perhaps strange to note the percentage of steam vehicles, and the almost total lack of electrics, except for the single Tilling-Stevens gasoline-electric. The former type of vehicle has met with ready acceptance in Great Britain, as well as on the Continent. For the most part they are designed to carry heavy loads. The Clayton & Shuttleworth, Foden, Garrett and Wallis were presented in three-ton models; the Allchin, Aveling, Foden, Garrett, Tasker and S. M. in five-ton; the Exshaw, Leyland and Yorkshire in six-ton, and the Wallis in eight-ton models. The Clayton & Shuttleworth also is produced in five and seven tons capacities. All are adaptable for use with trailers. The Aveling and Leyland makers produce gasoline machines as well.

The gasoline machines on display included: Adler, Albion, Alldays, Argylls, Austin, Autocarrier, Aveling, Bayard, Belsize, Benz, Berliet, Berna, Brazier, Buessing, Charron, Churchill, Commercar, D. A. A. G., Daimler, De Dion-Bouton, Delahaye, Dennis, Economist, Fiat, Girling, Globe, Hallford, Halley, Hillman, Karrier, Laycock-Goodchild, Licorne, Leyland, Mass, Maudslay, McCurd, Milnes-Daimler, Minerva, N. A. G., Napier, Pagefield, Pedrail, Phanomobile, Renault, Salmon, Scout, Standard, Star, Stoneleigh, Straker-Squire, Thornycroft, Tilling, Unic, Vinot, Wolseley.



Wolseley 3.5-Ton Chassis, Designed to Conform with the Subsidy Requirements of the British War Office.

The show was a success in every way. Perhaps it might be held that it had for its chief object the interesting of the business man in the economical advantages to be obtained from the use of the mechanical transport. As an example of the methods employed to demonstrate this feature mention may be made of the object lesson presented by the attendants at the Hallford stand. The existing rail rate between London and Birmingham varies from $4.50 to $11.25 a ton, according to the class of goods carried, but for some time, one of the Hallfords shown has been hauling all classes of goods between these two points at a rate of $3 a ton. Such arguments are not exactly new to British business men, but there is little doubt that this exhibition gave abundant opportunity to bring these facts more directly to the attention of men who were investigating the situation.



Commercar Six-Ton Tipping Wagon with Telescopic Worm Gear Hoist, Driven Through Special Clutch.

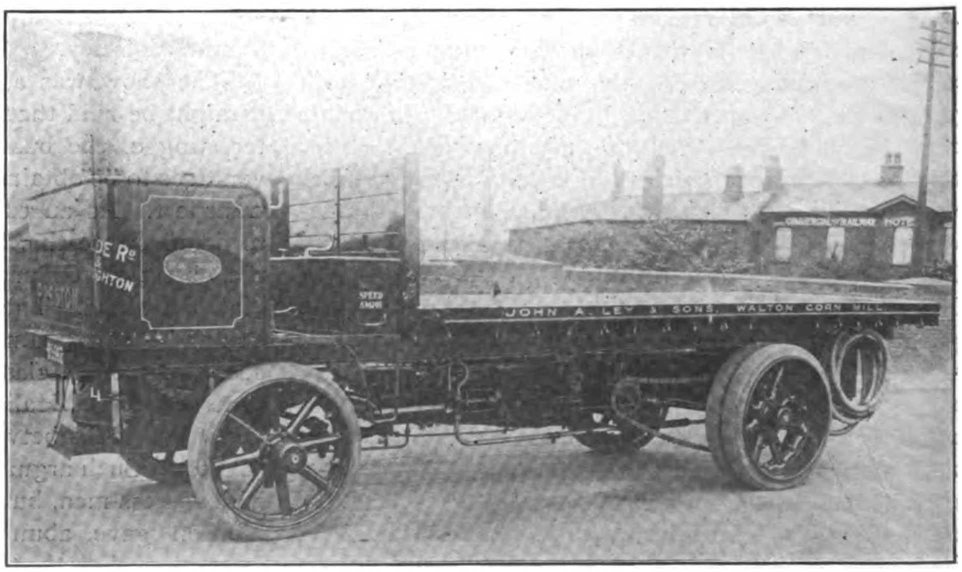
A visit to the various stands could not help but indicate that the specifications set forth in the conditions under which motor truck owners may receive the war office subsidy has had its effect upon chassis design. A series of trials is to be held by the war office in October, and it would appear that many British makers are striving to conform to the requirements in order that British purchasers of commercial wagons who wish to have their vehicles subsidized by an annual donation from the government may be in a position to secure a machine suitable for their needs and at the same time available for bonus and employment by the authorities in time of war.

The Leyland six-ton chassis shown herewith may be taken as an example of the steam vehicle construction which has proved successful in Great Britain. This particular chassis was designed for J. A. Ley & Co., of Preston, England, a firm which purchased its first Leyland steamer in 1903. That machine is still doing useful work six days a week. The latest model, like the older type, has a vertical fire tube boiler and an underslung engine, although there is a notable difference in the utilization of mushroom valves instead of those of the sliding type, which is held to make for the use of steam of a higher temperature and therefore for greater economy in running. A two-speed transmission and side chains deliver the power to the rear axle.

Several of the steam wagons were shown with tipping bodies. Both the Exshaw and Yorkshire designs are mechanically operated, the former utilizing a hydraulic jack worked by a small steam pump, the arrangement being such that the load may be dumped either to the right or the left as desired. The Yorkshire device may be operated either by hand or mechanically, the latter being accomplished by means of a clutch on the flywheel. When placed in action the body travels backward into such position that it does not actually begin to tip until the point of support is over the back of the frame. The Exshaw also is fitted with a winding drum on the differential shaft, operated by the steam engine, this being utilized for loading and unloading or when it is desired to employ the power as a stationary engine.

The automatic coupling for trailers on the Allchin model also is of interest, this being self-locking in action and designed to prevent accident to the man attaching the drawbar. The driver sets a trigger arrangement, so that immediately the end of the drawbar enters the mouth of the bracket, it is guided to a central loose piece which, when pressed like the trigger of a gun, releases the drawbar pin and drops it into position, thereby locking the assembly. The Allchin also employs a trailer brake, which may be operated by the driver by depressing a pedal from the seat. A similar arrangement appears on the Leyland, as well.

Considering the gasoline vehicles: Special attention was drawn to the Austin stand, where the new 2.5-ton chassis was shown for the first time. The particular feature of this machine is the method of transmission from the differential shaft through two angularly disposed cardan shafts and bevel gearing to each of the rear wheels. It is maintained by the maker that the necessity for torque and thrust rods has been eliminated by the special arrangement of double springing, which is a combination of the underslung and overslung types. The chassis is built for work

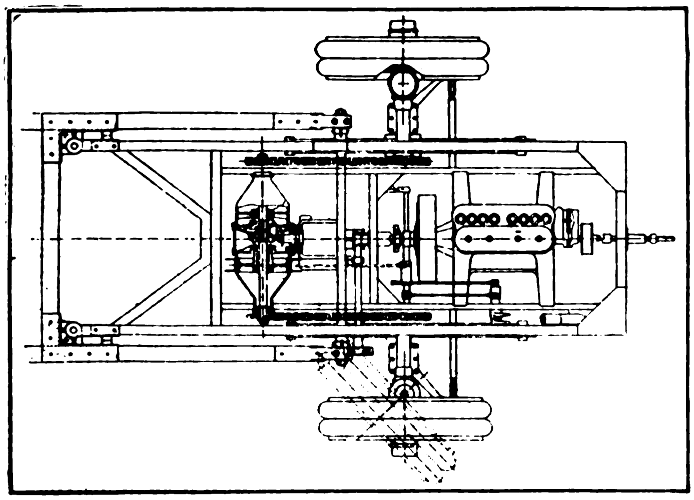


Leyland Six-Ton Steam Truck, an Example of This Type of Vehicle Which Has Given Excellent Satisfaction.

in any country and on all kinds of roads, and may be fitted with tipping gear and winding drum. Other exhibits at this stand were a 15 horsepower delivery van supplied to the postal authorities at Pernambuco, Brazil, and an ambulance fitted to the same chassis.

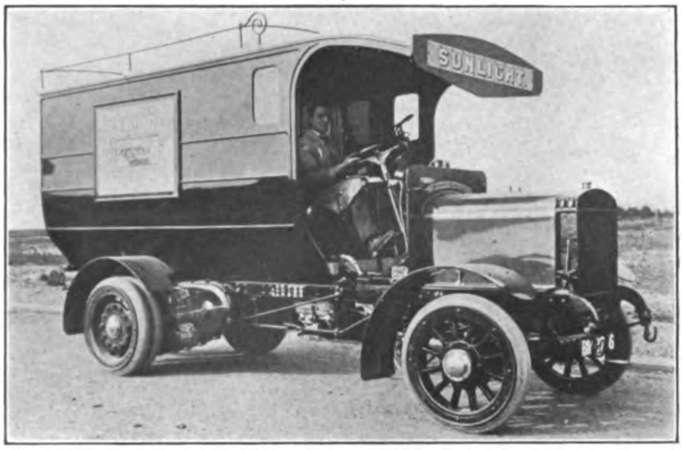
The Aveling three-ton gasoline wagon is of recent introduction, the firm being known chiefly as a builder of steam vehicles. It has a four-cylinder engine, cone clutch and four-speed gearbox. Drive is by shaft to a worm driven rear axle, the casing for which consists of massive steel castings. The rotative effect is resisted by a cast steel triangular torque member, while the top leaves of the rear bearing springs are left to take care of the tractive effort. A feature of the design is that of carrying and anchoring the blocks for the foot brake gear. These are secured to a bridge piece, each of the blocks being anchored to a crosshead, which is free to slide vertically.

In view of the interest taken in subsidized models, the German Buessing, which is the only machine subsidized by Hungary, and which is also approved by Austria, Prussia and Bavaria, attracted particular attention. The single model shown was rated at five tons. The four-cylinder motor is of 40 horsepower. The clutch is a cone. The power is taken by means of a long propeller shaft to a combined gearbox and differential, which makes provision for four forward speeds and reverse. The final drive is by big side chains. The suspension is of special interest. The front springs are aided by additional coil springs both fore and aft, while the rear springs carry the weight on a combined arrangement of rollers and pivots. The spring mounted radius rod is another characteristic of the design. The body shown was divided into two compartments, which may be dumped together, or either separately.



Sketch Showing Details of Mass Front Drive Tractor Construction.

Another example of the mechanically operated tipping body was found at the Commercar stand, this having been sold for service in Toronto, Canada. This is fitted with a telescopic worm gear, which is driven by means of a special clutch through a worm and chain set from an extension in the gearbox. In the main the chassis follows standard Commercar design.

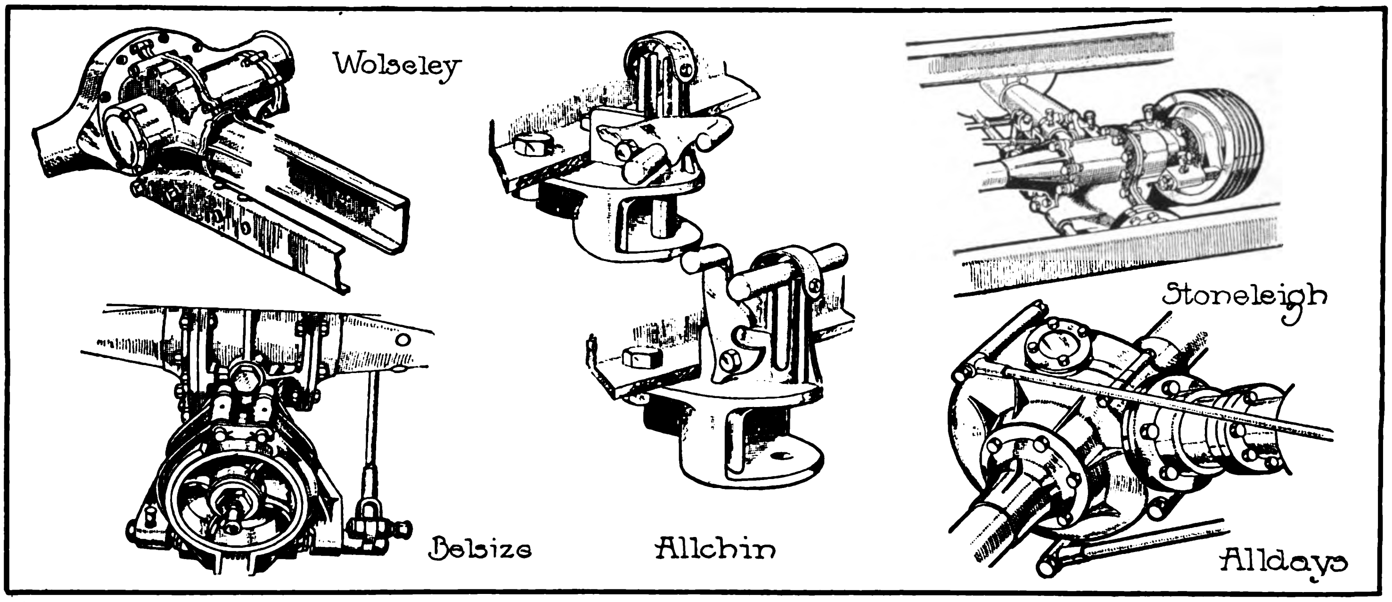


Commercar Four-Ton Box Van, One of a Fleet of 14 Operated by Soap Concern.

The maker also displayed a four-ton box van, one of a fleet of 14 sold to a British soap concern.

Front-drive machines are somewhat new in Great Britain, and for this reason considerable interest centred about the Mass tractor stand. This is made under the so-called Bezancon patents. The motor is of the vertical type, with four cylinders, cast en bloc. Centrally disposed forward of the front axle, the four cylinders run parallel with the frame. The power unit is mounted on a sub-frame, which is of pressed steel, of channel section and wood packed. Power is transmitted through a cone clutch, the speed change and differential gears being enclosed in one casting, located immediately behind the clutch. The differential shafts project outwardly from the frame sides, and the sprockets fitted thereto take the drive, which is transmitted through a light roller chain. Each forward chain wheel is situated over the front axle close to the swivel point. The same shaft has at its outer end a small bevel, which meshes with a second bevel wheel, horizontally disposed at the top of each swivel pin, thus forming a pair of mitre gears. At the bottom end of the pin is fitted a further bevel pinion, which engages with the crown bevel bolted to the hub of each front road wheel. The whole arrangement is more completely brought out in an accompanying sketch.

Austin Delivery Van Supplied to Postal Authorities in Pernambuco, Brasil.



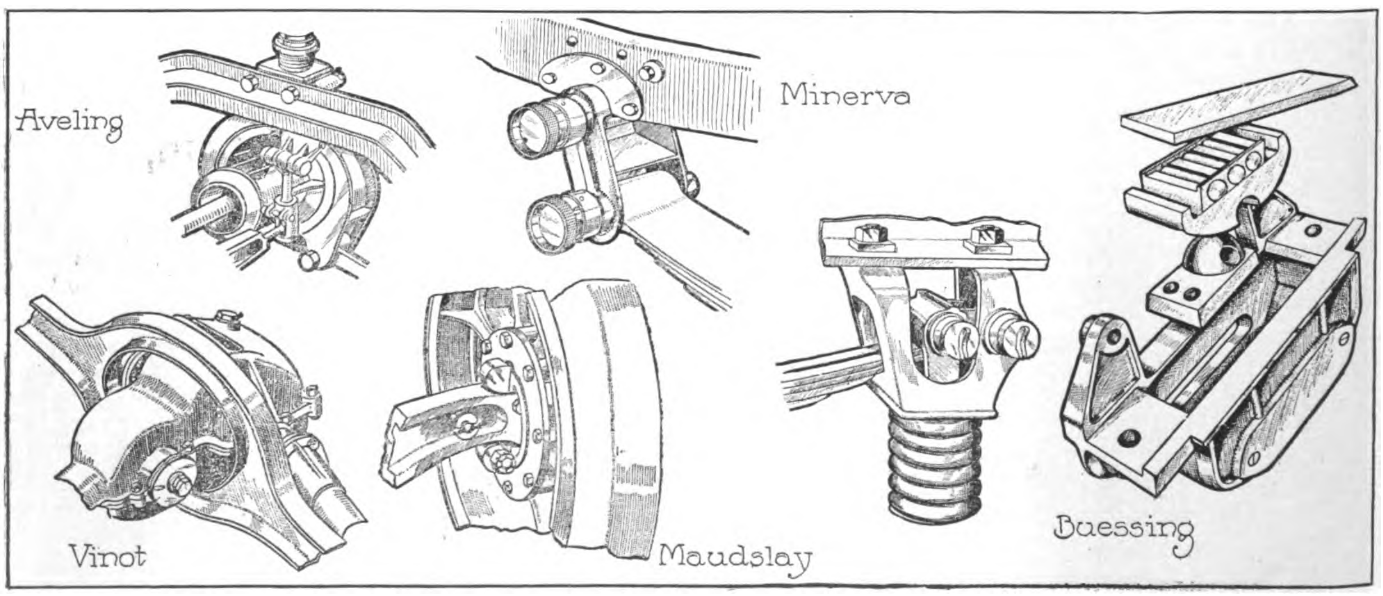
Mechanical Details Revealed at Olympia: Wolseley Bridged Axle and Double-Channel Torque Member, Brake at Back of Belsize Gearbox, Allchin Automatic Coupling Opened and Closed, Air-Cooled Brake Drum on Stoneleigh, and Torque Members on Alldays Differential Gearcase.

Still another new design is the 3.5-ton McCurd. This is said to conform in all its dimensions to the new Scotland Yard regulations for motor 'buses. Accessibility to all parts, and the easy mounting and dismounting of them are its leading features. Three independent sets of brakes are fitted, two of these being side brakes, one operated by the foot and the other by hand, and the third is located on the countershaft. The change speed device is what is termed a reversed gate, this being recessed so that the gate is underneath the rocking centre above it.

One of the features of the Wolseley 3.5-ton chassis, designed to conform with the war office subsidy requirements, is the new type of rear axle, which is of the bridged construction, with the main forging inclined 45 degrees to the vertical. Particular attention is drawn to the combined radius and torque bar.

The Stoneleigh model is produced by the well known maker of Siddeley-Deasy pleasure cars. It is fitted with a 24 horsepower Knight engine, inverted cone clutch and transmission affording three speeds forward and reverse. The rear axle is worm driven, and this and the gearbox are rigidly connected by a stout torque and thrust tube, which encloses the drive shaft. Another feature is the position of the foot brake. The worm shaft is extended backward and mounted thereon is a ribbed brake drum surrounding a pair of expanding shoes.

Space does not permit of mentioning in detail all of the new features presented, and it will be found that some already have been described in these columns. This is particularly true of the D. A. A. G., the Halley Colonial model, the Pedrail and others. The Pedrail attracted unusual attention because of its novelty. In general the principal employed is somewhat like the so-called caterpillar design in America, although it is termed an elephant foot in Great Britain. The ordinary driving wheels are replaced with a series of wheels, over which an endless chain deposits a number of sections of hard rubber upon the ground.



Constructional Features in Olympia Display: Spring Mounted Brake Anchorage on Aveling Gasoline Chassis, Large Spring Links and Their Oilers on Minerva, Pressed Steel Rear Axle on Vinot, Centre Pivot Steering Wheel on Maudslay, and Front and Rear Auxiliary Springs on Buessing.

DELIVERING STRUCTURAL STEEL BY TRUCK.

By George D. Crain, Jr.

GRAINGER & Co., Louisville, Ky., manufacturer of structural steel and iron, has turned from the use of animal vehicles to the motor truck for the delivery of stock within the normal range of motor delivery, making shipments outside of the city by railroad, there being a spur track from a railroad to the works. The company does an extensive local business, there being a foundry in connection with the works, and as it will build anything, from a gate to a building frame, and from a casting weighing a pound to one weighing several tons, it will be understood that the haulage equipment must have capacity to handle it.

The company, prior to using a motor truck, used a truck and a team of two mules, and where the work was of large size had contract with a company specially equipped for heavy transportation. When the change was decided on it was found desirable to have a machine that would serve all requirements, and a vehicle was built by the Transit Motor Car Company. While the machine was rated as two tons capacity it was designed to endure under a considerably heavier load. For instance, the rear axle was made much larger, the wheels and tires were made heavier, and the chassis frame was lengthened so as to take a body adapted for the handling of metal rods and strips. The rear axle is a size usually built into a 3.5-ton truck, and the wheels are fitted with 36 by five-inch band tires forward, and 46 by four-inch dual block at the rear. The motor was fitted with a Pierce governor that is set for a maximum speed of 12 miles an hour. The truck body is low, wide and long, and overhangs the chassis frame at the sides and ends, so that it is possible to load it and have the centre of gravity comparatively low.

The Specially Built Transit Truck Used for Delivery by Grainger & Co., Structural Steel Builder, Louisville, Ky.

Since the truck has been in service a great deal of the haulage that was formerly done by contract has been done by it, and it has been necessary to resort to contract work only when the construction is such that special equipment is required to handle it. Viewed from an experience that was begun last December, the motor truck has made practical a decided saving. For instance, the company has a machine that has at least double the capacity of the mule truck when measured by mileage, and there is a considerable saving because the additional work was paid for at contract prices.

The actual cost of operating the mule team truck included $34 a month for stabling, $4.80 a month for shoeing and $40 a month for the driver, a total of $78.80 without considering depreciation, interest, taxes, maintenance and other expenses. During the eight months previous to December, 1912, the expense for drayage was $411.60, an average of $51.45 a month. Adding this to the expense previously stated for operation the total is $130.25.

When the truck was placed in service care was taken to load it rationally, and for this reason more work was done by the contractors than was found necessary later on. The cost for the driver at $14 a week for three months was $182, and the expense for fuel, oil, supplies, accessories, etc., during the same period was $62.67. Adding to this the charge for haulage of $53.75, the total was $298.42. The monthly average is $99.47, and contrasting this with the total of $130.25, there is a saving of $30.78. This is an average of $1.23 a day, or $369.36 a year. Taking the actual cost of operation, without figuring interest, depreciation, or other charges, the truck cost during the three months $81.55 a month as against $78.80 for the mule team truck, this being a difference of but $2.75.

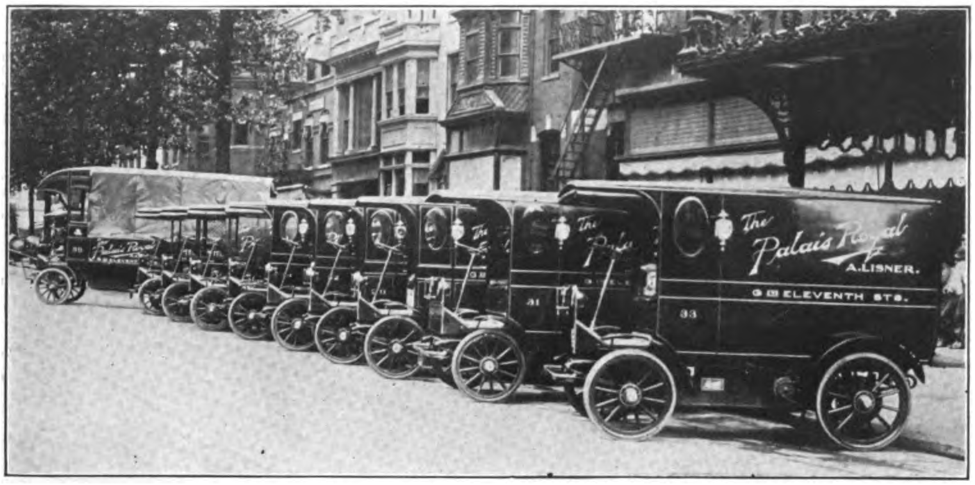
It will be understood that there are no fixed charges or depreciation included in the above figures, but it will be seen that with the same volume of contract work as was required during the first three months the saving is approximately $1.23 a day, which will probably be sufficient to meet all the expense of overhauls and replacements, as the company has its own machine shop and mechanics capable of doing whatever mechanical work may be needed. Not only this, but it is believed that there will be a considerably greater gain in earning capacity, as the company can deliver in a much larger area, and the truck will be sufficient to keep pace with the business development for several years in all probability. The machine has on some days handled from 15 to 18 tons of steel, more than twice the tonnage that could be hauled with mules.

DEPARTMENT STORE ELECTRIFIED.

Palais Royale at Washington, D. C., Has Delivery Fleet of 10 Detroits.

The Palais Royale department store at Washington, D. C., of which A. Lisner is proprietor, has a delivery equipment of 10 Detroit wagons, built by the Anderson Electric Car Company, Detroit, Mich., and for its service in that city uses no other vehicles. The first two machines ordered were delivered early in 1911, and were used with horse wagons. These proved to be so satisfactory that in the latter part of the same year two more wagons were purchased, and some of the horses were disposed of.

The four wagons gave even greater satisfaction as experience was gained and in 1912 a 3000-pound wagon fitted with a body designed for carrying furniture was ordered, and this spring five more wagons were purchased, this making a fleet of 10, six of them being 1000-pound chassis fitted with panel bodies, three 2000-pound chassis fitted with panel bodies, and the furniture wagon. The loading space of the 1000-pound wagons is 73 inches length and 43 inches width, of the 2000-pound wagons 80 inches length and 48 inches width, and the furniture wagon has a body 13.5 feet length, six feet width and 6.5 feet height. All of the wagons are equipped with Edison batteries.



The Fleet of 10 Detroit Electric Wagons in the Delivery Service of the Palais Royale, a Washington, D. C., Department Store.

The results from this delivery equipment have been very satisfactory, the cost being reduced as compared with horse wagons, the customers are better served, and the excellent appearance of the machines has an advertising value that has been materially productive.

Seagrave for Athol, Mass.—Athol, Mass., has installed a Seagrave combination hose truck, made by the Seagrave Company, Columbus, O., at a cost of $5500. It is figured that the machine will pay for itself in a short time, on the difference in the cost of maintenance between it and the horse drawn machines it supersedes.

ELECTRIC CLUB'S OUTING.

Boston Vehicle Men Guests of the Boston Edison Company at Braintree.

The annual outing of the Electric Motor Car Club of Boston took place July 17 at the New England Kennel Club's house at Braintree, Mass., where the members to the number of 75 were the guests of the Edison Electric Illuminating Company of Boston. The members were taken to the club by automobile and while the Electric Vehicle Victors and the Central Stations Stars were playing at baseball another group was shooting at clay pigeons. The Victors won by a score of 17 to eight, and the honors of marksmanship fell to H. S. Hale and John L. Snow.

The dinner was extremely satisfying, and following this three applications for membership were acted upon favorably and then came a series of brief speeches by President Edgar of the Boston Edison Company, Fred M. Kimball of the General Electric Company, President Whitesides of the Stevens-Duryea Company, General Manager Atkins of the Boston Edison Company, D. C. Tiffany and John L. Snow. Albert Weatherby of the Anderson Electric Car Company thanked the Boston Edison Company and H. S. Hale of the New England Kennel Club for their hospitality, and General Manager Atkins of the Boston Edison Company announced that the company had decided to offer a handsome silver loving cup, to be competed for by baseball teams composed of members of the club and allied interests. A committee of three, of which Col. S. R. Bailey is chairman, was appointed to arrange for the organization of the clubs and fix a playing schedule.

KISSELKARS IN TEXAS SERVICE.

Two Machines Will Carry Mail, Freight and Passengers in Kimball County.

The Kissel Motor Car Company, Hartford, Wis., has sold to the Southwestern Motor Transit Lines of Texas, a five-ton KisselKar combination express and freight truck and a 1.5-ton passenger and mail car. These machines are used in regular trips between Menard and Junction, Tex.

Connecting with a railroad at Menard, the machines will penetrate Kimble county 30 miles to Junction. The company has contracts with the United States government to carry the mail and with the municipality of Junction to handle all city freight and supplies. Kimble county is in southwest Texas and not a railroad crosses its borders.

ELECTRIC VEHICLE PRACTISE.

Principles of Primary and Secondary Cells and the Functions of the Metals and Solutions Composing Them---Fundamentals of Chemical Action and Reaction in Charging and Discharging---Some Early Types of Plates.

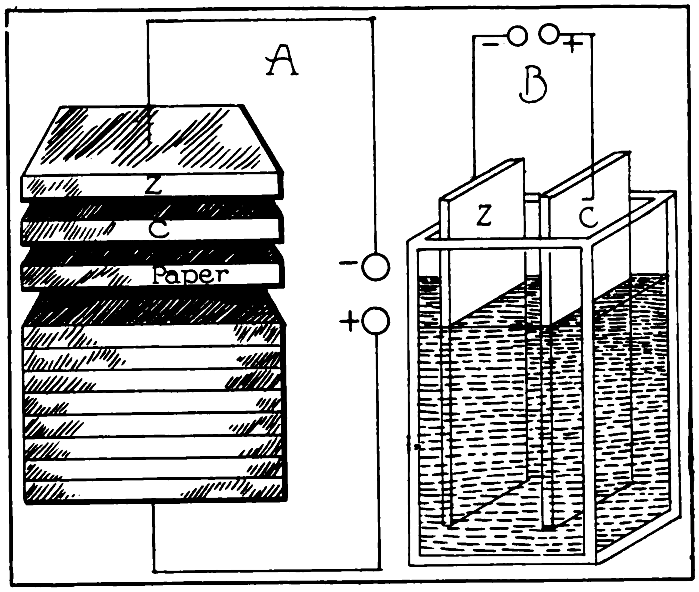
By William W. Scott.

THE energy by which the electric vehicle is propelled is drawn from a battery of cells in which electric current is stored or charged. Strictly speaking, this is an accumulator for current mechanically created, and then this current is at the will of the operator transformed to mechanical power. The battery, as it is accepted by the electrical world, is composed of secondary cells, for a primary cell is that which generates current chemically, and which has decidedly limited capacity and power. It is practical, however, to build batteries of secondary cells of very large size, sufficient in fact to be used as a reserve for lighting and power plants. Naturally these cells correspond to the proportions of the batteries. There is no variance of principle in the construction and use of secondary cells, although the materials may differ from every point of view.

Literally, the functions of a secondary cell are chemical action and reaction, resultant from the flow of a direct current of electricity through the cell for a stated period. The capacity of the cell is limited and it will not yield in useful work all of the energy used in charging it. That is to say, that the output of power will not equal the input. The efficiency of the cell is comparatively good, and it is a fact that the capacity of the earliest constructions were practically, if not quite, the equal of those of the present day. The function of the lead battery cell is principally of the nature of the materials and it is susceptible to but little change, by alteration in design, etc. The endeavor of electrical engineers, or more properly battery engineers, has been toward improvement in the reduction of weight and increasing the durability of the element.

The principle of the voltaic pile is probably the most familiar of any electrical device. This is constructed of plates of copper and zinc placed in regular order, each pair of plates being separated by a layer of absorbent material, such as blotting paper, dampened with acid. The plates may be copper first and zinc second, and then a sheet of paper, this order being followed through until the pile is completed. When finished the outer disc at one end is zinc and at the other copper. One outside or end disc is the positive and the other the negative. Were wires connected with these two discs and these wires coupled there would be a flow of energy through them that would be proportionate to the size and number of the plates. This current would result from the galvanic action of the two dissimilar metals.

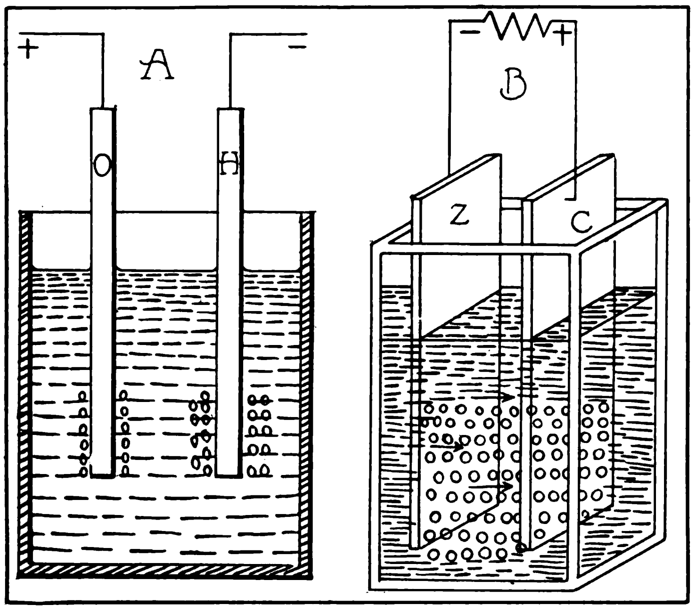
There are such decided limitations to the voltaic pile, so-called, that the voltaic cell was next created, this being a jar of glass or non-porous earthenware in which in a solution of sulphuric acid are suspended a sheet of copper and a sheet of zinc, each plate of metal having a wire connected with it. When these two wires are joined a current of electricity will flow through them, and the direction of the flow will be from the copper to the zinc. The diluted sulphuric acid that constitutes the electrolyte will attack the zinc plate and will in time dissolve it, or at least that portion of it exposed to the solution, but there will be no material influence manifested upon the copper, which serves merely to conduct the electric energy. The copper or passive plate is termed the positive, and the zinc the negative, but these terms are in reality



The Voltaic Pile and the Voltaic Cell: A, the Voltaic Pile of Alternate Sheets of Zinc, Copper and Acidulated Paper; B, the Cell of Zinc and Copper Plates and an Electrolyte of Dilute Sulphuric Acid.

applied to the poles of the cell and not to the plates themselves, which are exactly the reverse of the accepted designations. That is, it is the gradual consumption of the zinc by the acid that creates the current of electricity, and the energy originates in this plate instead of the copper element. Consequently the zinc plate is the positive or productive agent. Similar results may be obtained by the use of carbon and zinc elements and a solution of sal ammoniac, and with other combinations of metals and solutions. The action that takes place in cells of this character is a union between dissimilar substances to form a new product.

The action of the electrolyte on the zinc plate will produce zinc sulphate, and this production is accompanied by the creation of hydrogen gas. This gas is



A, Illustration of the Formation of Oxygen Gas and Hydrogen Gas at the Positive and Negative Plates During the Decomposition of the Water in the Electrolyte; B, the Manner in Which the Positive Plate Is Polarized by Hydrogen Gas.

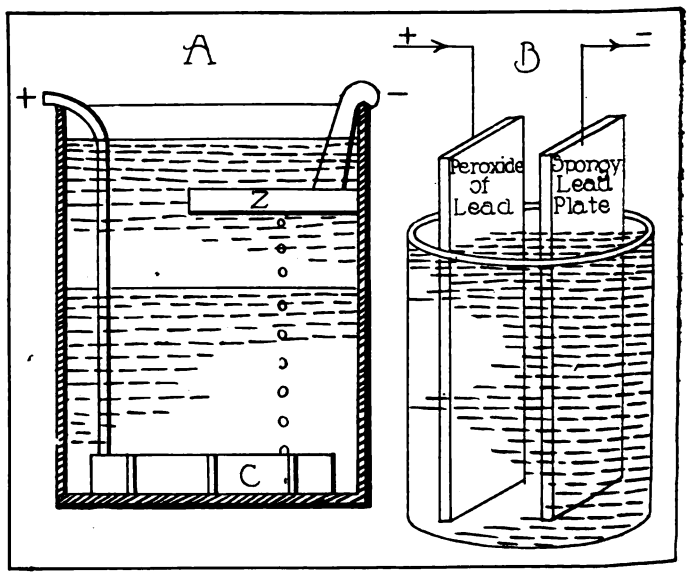
created in the form of "ions" or atoms, and these atoms will pass through the electrolyte from the zinc plate on which they originate and will manifest themselves in the form of accumulations of tiny bubbles on the copper plate, to which they are attracted, until the hydrogen gas on the positive plate has such volume that it will practically prevent the movement of the electric current. When the accumulation of hydrogen gas has so prevented the movement of the current the cell is said to be polarized. This process of polarization is gradual and the current diminishes as the volume of hydrogen gas increases. In a sense the gas insulates the positive plate against the current of electricity. It is possible to observe the accumulation of the hydrogen bubbles upon the positive plate. As the electrolyte attacks the zinc the temperature of the cell will rise.

It is practical to depolarize a cell—that is, to remove the hydrogen gas from the positive plate—by mechanical, chemical or electro-chemical means, and all primary cells employ one of the three methods to bring about depolarization. The mechanical depolarization is accomplished by agitating the electrolyte, by blowing air through the electrolyte, and by using rough plates, which divert the course of the hydrogen gas to the surface. The chemical method is by combining a chemical with the electrolyte that will create oxygen, a gas for which hydrogen has a great affinity, which will unite with the hydrogen and prevent its accumulation. The electro-chemical method is in the use of two solutions that normally are separated from each other by gravity. For instance, an element of zinc is suspended in a jar and an element of copper is placed at the bottom, and around this is heaped a number of pieces of copper sulphate. The two solutions are sulphate of zinc, which is lighter, and sulphate of copper, which is heavier. The hydrogen gas created at the zinc element is attracted toward the copper, but as it enters the sulphate of copper solution a particle of pure copper is substituted for it, and this copper particle descends and attaches itself to the copper element. Thus there is a constant deposit of copper and an absence of hydrogen gas, which means uninterrupted strength and activity of the cell.

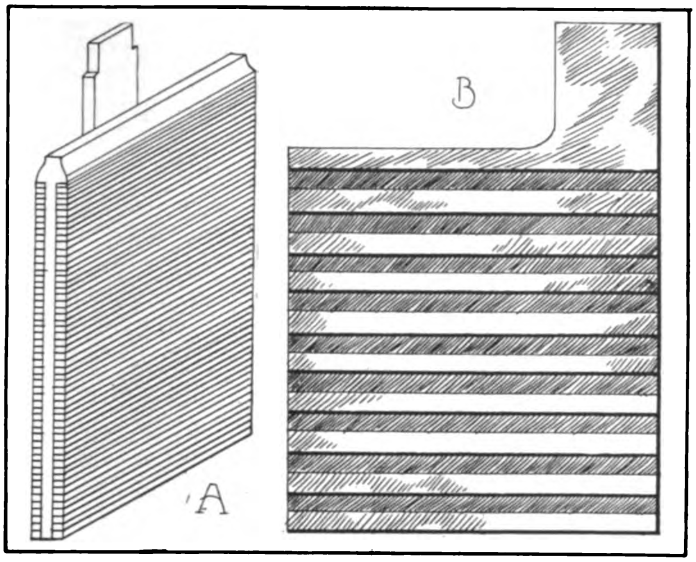
Such cells as have been described are primary and the energy that will be produced in them is dependent upon the elements and the solution, as well as the proportions. But it is evident that primary cells have neither the capacity nor the endurance that are necessary to serve for vehicle propulsion. The secondary cell has been developed from the experiments of Gautherot, who in 1801 found that when two plates of silver or platinum were suspended in an electrolyte and connected with the terminals of an active primary battery and the current permitted to flow, a current of lessened strength would flow when the two plates had been connected, after the connection with the primary battery had been broken. In other words, the primary battery created an activity in the second cell.

An electrolyte made of sulphuric acid diluted with water was used and it was found that the resistance of the electrolyte decreased up to a certain point as the proportion of acid was increased. The current passing through this electrolyte decomposed the water, the oxygen gas bubbles forming on the plate coupled to the positive pole of the galvanic cell, and the hydrogen gas bubbles forming on the plate coupled to the negative pole of the primary cell. As the oxygen could not attack either of the plates the gas escaped from the electrolyte when the plates were covered with bubbles. From this point no more energy could be accumulated. When the current from the primary cell was broken and the two plates were connected by wires a current was created by the recomposition of the gases to form water.

Analyzing the process, it will be seen that it is in a practical sense a reversal of that by which a current is created in a primary cell. Hydrogen gas is formed



A, the Gravity Battery, the Sulphate of Zinc and Sulphate of Copper Electrolyte Being Maintained as Shown, the Hydroden Gas Descending from the Zinc Element Being Transformed to Copper; B, Simple Form of Storage Battery with Lead Element and a Solution of Sulphuric Acid and Water.



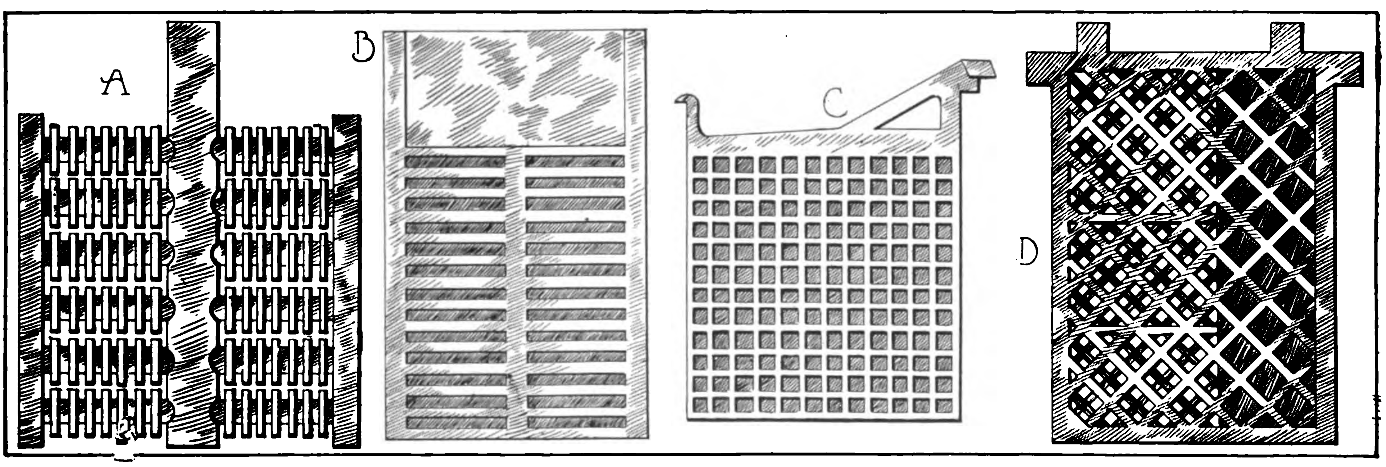
A, Grooved Lead Plate Used in Plante Formation; B, Ribbed Plate in Which the Active Material Was Solidified in the Channels.

on the negative plate, which is the cathode or outlet for the negative current during the period the primary battery is connected. Simultaneously oxygen is created at the positive plate. Both of these gases are atomized into "ions" and these flow through the electrolyte, the oxygen from the positive plate to the negative, and the hydrogen from the negative plate to the positive. There is a surplus of hydrogen from the fact that water when decomposed will yield twice as much hydrogen as oxygen. This process will continue as long as there is a flow of hydrogen gas "ions" from the negative to the positive plate, and this is the discharge of the cell. When the recomposition of the gases has been accomplished activity is ended because the gases do not combine with the metal of the plates. This explanation makes clear why this form of cell is known as secondary, and the term applies to the principles established by Gautherot.

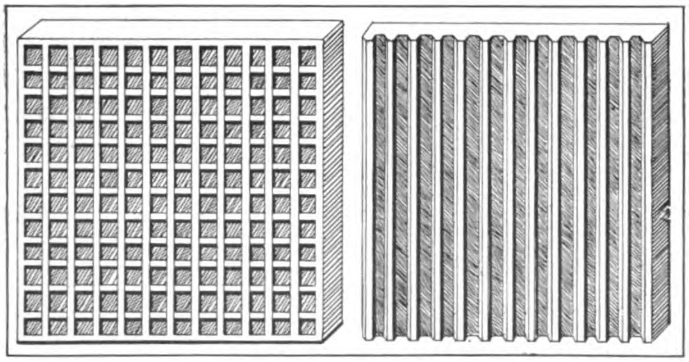
As there was, as stated, a limit to the capacity of the cell with the silver and platinum plates because oxygen will not have the same influence upon them as other metals, to construct cells that would be practical with reference to capacity, weight and endurance it was essential to use elements in which the active material would be practically insoluble in the electrolyte at all times, so that they might be changed during the period of charging and brought back to their original condition during the period of discharge. For many years lead or compositions of lead were the only practical metals that gave substantial results in practise, and to this nickel and iron were added with the construction of the Edison alkaline cell. In practical operation lead is highly influenced by oxygen, but it is not completely restored to its original form and eventually it will lose its restorative qualities, and, consequently, its capacity. For all purposes, however, the lead plate cell will endure exceedingly well, and with the care and attention that should be given, a lead plate element will afford highly satisfactory service. It is possible to obtain maximum efficiency from an exhausted cell by renewal of the plates.

The secondary cell was not regarded as practical until developed by the experiments of Gaston Plante, a noted French electrician, who about 1860 succeeded in producing capacity. The original construction was in the form of strips of lead wound spirally, these strips being separated by strips of sheet rubber or canvas, used with dilute sulphuric acid as an electrolyte. When a primary cell was coupled with this type of cell hydrogen collected on the surface of the negative plates or strips, but instead of the oxygen collecting on the positive plate, as with Gautherot's silver and platinum cell, in the form of bubbles the oxygen caused peroxide of lead to form on it. But to bring about the necessary changes in the metal the plates were "formed" by charging and discharging the cell, using each terminal alternately as the positive and negative, and varying the periods of charging and discharging.

The forming process required something like 60 days, and the effect was that the lead peroxide accumulated on one plate was dissipated, the plate changing in color from brown to that of metallic lead, this plate becoming porous and sponge like in texture. As peroxide was reduced on this plate it was formed on the surface of the other plate. The porous, spongy lead plate was the negative and the peroxide-coated plate the positive. The porous nature of the negative plate



A, One of the Forms of Plate Used with the Faure Construction; B, the Type of Grid Adopted for the Brush Cells; C, Lead Plate with Pockets for the Active Material; D, a Grid Employed for the Correns Cells.



Frames of Unglazed Porous Earthenware, the Square Containing the Active Material and the Channelled Member Serving as a Separator, Used with Sheet Lead Electrodes.

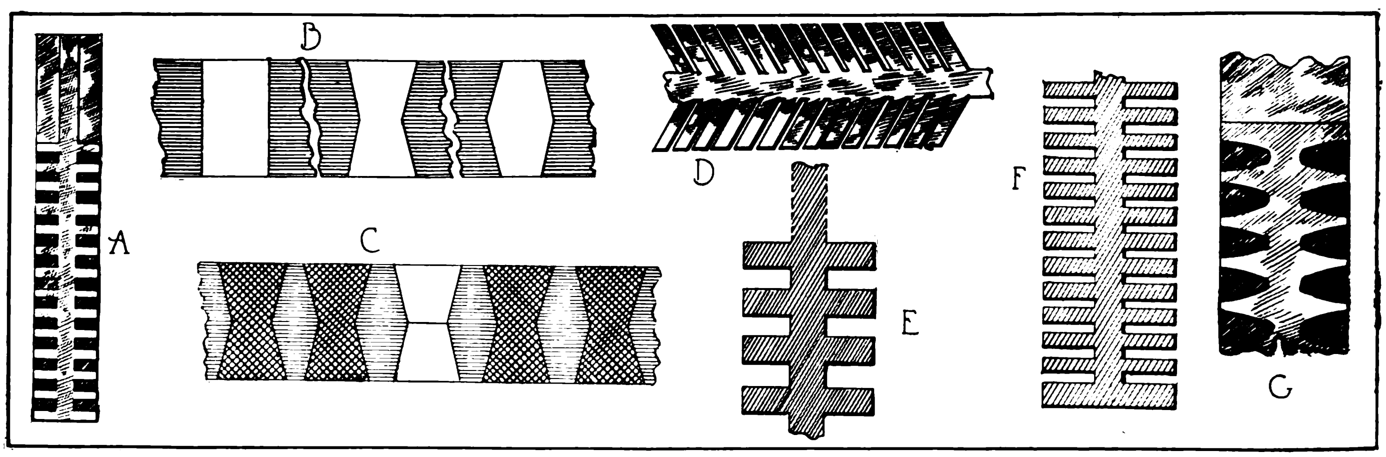
afforded a very large area in contact with the electrolyte, which exposed a greater surface for action and brought about the cell capacity. The efficiency of the plates formed by the alterations of the charging current was high, but the great objection was to the length of time and the expense necessary in forming them, as well as the fact that, due to poor mechanical construction, the plates did not long endure. As a substitute for this the metal was subjected to chemical treatments with a view of hastening production and lessening the expense, and the different engineers who followed in this work utilized varying methods and materials in their constructions, retaining, however, the lead as the basis.

The method of forming plates by electrolytic action, or the reduction of the material to the required oxide, is essential. The process of making plates that was covered by patents granted in this country to Charles F. Brush, was also created in France by Camille Faure, and this type of plate is in general use today in practically all lead or acid cells used for automobile vehicle service, whether for ignition, lighting, propulsion or other purpose. Such plates are known by the name of the French electrician, and Brush's name is seldom heard of in connection with the process. The Faure method has been known since 1880, and it has been developed from time to time by different manufacturers and engineers, the methods usually being carefully kept from publicity because of qualities that each particular production is supposed to have. In cells used for stationary purposes the Plante type of plate is very generally utilized, and in some instances both the Plante and Faure constructions are used, the plates being alterations of each form.

The Faure type of plate is primarily a frame constructed of lead or of a composition of lead and antimony to give strength, and the frame may be one of numerous forms, the purpose being to have a large measure of conductivity and such form as will retain the active material applied as paste and hardened. In some instances the plates are perforated, in others are slots or openings, and sometimes they are grids, the design being dependent upon opinion as to efficiency and durability. The paste is known as the active material and in the first instance red oxide of lead was used, this being changed by the forming current to the peroxide of lead for the positive plate and spongy lead for the negative plate. Later on red lead oxide ($Pb^{3}O^{4}$) was used for the positive plate and lead monoxide or litharge (PbO) for the negative. The early types of grids or frames were heavy and thick, the area of surface exposed to the electrolyte comparatively small, and numerous faults were developed.

One was the tendency of the frames to buckle or bend and the plates to contact, and another was the disintegration of the active material, lessening the surface area, diminishing the capacity and the length of service, while the particles of free active material caused short circuits if caught between the surfaces of two plates. In some instances positive plates are made with a series of rolls of lead ribbon forced into openings in the frames, and these are formed by the use of an electric current. Negative grids are sometimes formed by casting the frame around blocks of composition that are afterwards treated with chemicals.

It is impractical to describe the different types of construction or the processes that are made use of by manufacturers, but generally speaking the plates are designed to have the qualities of lightness, large surface area, strength and durability. Much depends upon the formation of the frames or grids, which are usually made with an arm or lug extending upward



A, Cross Section of a Brush Plate; B, Forms of Pockets Used by French Makers of Plates of the Faure Type; C, Forms of Pockets Used by English Makers of Plates of the Faure Type; D, Cross Section of a Plate Rolled from Lead for Plante Formation; E, Channelled Plate for Plante Construction; F, Another Form of Channelled Type; G, Form of Channel in One Design of Tudor Plate.

from one corner, the purpose of this being to engage with straps that will hold the plates in a fixed position in the cell. With some types of cells the arm or lug is so shaped that it may be suspended from the side of the jar or container, and others are supported by bolts or rods, each group of positive and negative plates being separate.

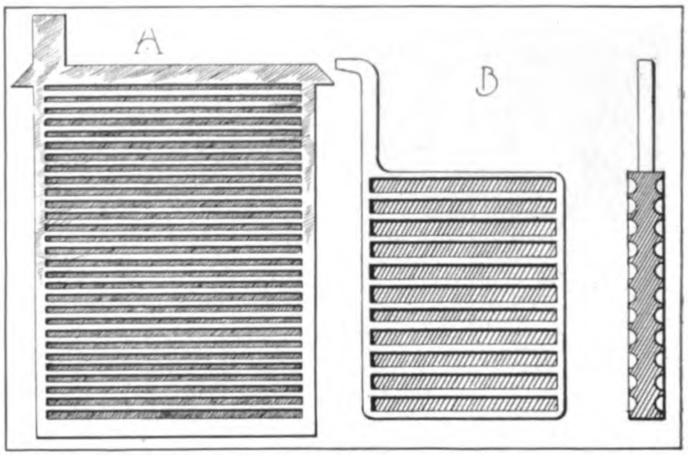
There is one exception to the constructions that have been outlined, and that is the "Ironclad-Exide" battery, made by the Electric Storage Battery Company, in which the positive plate consists of lead top and bottom members connected by vertical rods that serve as conductors. Each rod is surrounded by peroxide of lead, the active material, that is retained by a thin shell or quill of hard rubber in which is cut a large number of horizontal slits, through which the electrolyte is brought in contact with the active material. It is claimed for this form of plate that the active material is retained in the rubber quills and, as very little if any of it is lost through chemical action, that the plate has unusually long life and capacity the equal of any other construction.

The cell may be contained in a glass, porcelain or hard rubber jar of such size as may be desirable, and the proportions are apparently determined more by experience than by any definite requirement as to volume of solution per surface area. Some jars differ from others, and generally all of them are made today with one or more ridges raised above the bottom of the cell on which the plates may be supported. It is necessary to provide a space below the plates, for the active material will gradually disintegrate and the particles will fall to the bottom. Each cell in use for a considerable period will have at the bottom a quantity of sediment that will resemble soft mud. Should such an accumulation reach the bottom of the plates it will short circuit them and the cell will be useless until the sediment has been removed.

Normally the frame of the negative plate is lighter than that of the positive plate. The assembly of plates is known as an element, and the positive plates are in one group and the negative plates in another, there being negative plates outside, with a positive plate between each two negatives, each about .1875 inch apart. That the plates may not contact with each other separators are ordinarily used. These separators are of wood and hard rubber. The wood has been found to be a thoroughly dependable material—in fact, nothing that is a satisfactory substitute is known—and before using this wood is treated with chemicals to remove substances which would cause complications were they to enter into the electrolyte. The wood separators are made with a series of shallow channels extending longitudinally in one side or face, and the other is smooth. The first outside plate is a negative, and the flat or smooth side of the wood separator is placed in contact with the negative plate. The rubber separator, which is a very thin sheet and perforated with many small holes, is placed between the wood separator and the positive plate, the reason being that the wood separator would char from the action of the positive plate were it in contact with it. This arrangement of the plates and separators is followed through the assembly.

With reference to the manner of assembling it will be seen that the plates are very close together, with the wood and rubber separators between, all the positive plates being retained by one series of lugs in a strap, and the negative plates being similarly secured. The purpose of the channels in the wood separator is to permit a free circulation of the electrolyte between the wood and rubber, that it may have access through the tiny perforations to the positive plate, and besides protecting the wood separator the rubber separator also prevents the washing action of the electrolyte assisting in the disintegration of the positive plate.

As may be assumed the space between each plate is small and the action is between each plate of each series, the united action of each series being the effective work of the cell. When the plates have been assembled and the electrolyte has been placed in the cell, the cell must receive attention. The electrolyte



A, One Type of the Plate Used in the Tudor Battery Cell, a Well Known European Construction; B, Another Type of Tudor Cell Plate, Showing Side and Cross Section—The Grooves Were Packed with Active Material.

is a solution that is approximately 40 per cent. sulphuric acid and distilled water. The first care the cell should have is charging, and the result is that the current, passing from each positive plate through the electrolyte to the negative plate, decomposes whatever lead sulphate may be present and transfers all of the oxygen from the negative plate to the positive. When the charging is completed the negative plate is free from oxide and is pure sponge lead, and there are no oxides in the positive plate other than peroxide, with the possible presence of some sulphate. At this time the electrolyte has its highest specific gravity. The positive plates are dark brown in color and the negative plates are dark slate color.

On the discharge of the cell the effect of the electric current is to decompose the water in the electrolyte, and both oxygen and hydrogen are created, the oxygen at the negative or sponge lead plate and the hydrogen at the positive or peroxide plate. When these gases are created they are more active chemically

than before and are more readily combined with other substances. The more active hydrogen will combine with oxygen in the lead peroxide, forming water, and the reduction of this oxygen reduces the degree of oxidization of the lead peroxide and transforms it into lead oxide. At the same time the oxygen created at the negative plate combines with that plate to form lead oxide. Thus it will be seen that the tendency of the two plates is to become alike in proportion to the discharge, and so the complete discharge would transform them both to the same substance. The radical of the acid combines with the active material of each plate, creating lead sulphate, and this loss of acid from the electrolyte reduces the specific gravity. The sulphate is increased as the cell is discharged, and when the cell has been practically discharged the sulphate is present in greatest volume. When fully discharged the positive plates are a chocolate brown in color and the negative plates are a slate color. When the plates are sulphated the positive plates are drab in color.

To consider the chemical action of the cell for a moment. Many engineers are thoroughly agreed as to certain general results, but as to precise charges there is a diversity of theory. The electrolyte used for the cell in service is a solution of 40 per cent. sulphuric acid and 60 per cent. pure water. The positive plate is peroxide of lead and the negative plate is spongy lead. When the plates, or element, are first placed in the electrolyte sulphation will be begun without the action of the electric current.

When the charging of the cell is begun the decomposition of the water of the electrolyte is begun and oxygen is formed at the positive plate and hydrogen at the negative plate. At the positive plate the oxygen enters into a combination with the lead oxide, adding oxygen and changing the surface of the plate to lead peroxide, while at the negative plate the hydrogen combines with the oxygen in that plate to form water, so that the oxygen is abstracted from the plate and the plate transformed to lead. In a chemical expression of the action the equation is:

CHARGING.

Positive Plate.

O	+	$H^{2}O$	+	$PbSO^{4}$	=	$H^{2}SO^{4}$	+	PbO^{2}
Oxygen		Water		Sulphate of Lead		Sulphuric Acid		Lead Peroxide

Negative Plate.

H^{2}	+	$PbSO^{4}$	=	$H^{2}SO^{4}$	+	Pb
Hydrogen		Sulphate of Lead		Sulphuric Acid		Lead

The chemical equation of the discharge may be thus expressed:

DISCHARGING.

Positive Plate.

PbO^{2}	+	$H^{2}SO^{4}$	=	$PbSO^{4}$	+	$H^{2}O$
Lead Peroxide		Sulphuric Acid		Lead Sulphate		Water

Negative Plate.

Pb	+	$H^{2}SO^{4}$	=	$PbSO^{4}$	+	$H^{2}O$
Lead		Sulphuric Acid		Lead Sulphate		Water

The equations that have been stated do not indicate the numerous changes that will take place in the charging and discharging of a cell. The charging is begun with both plates showing practically the same condition with the presence of sulphate of lead, and with the dissipation of the sulphate of lead the plates are transformed, the tiny crystals of sulphion being broken up and uniting with the water increases the volume of sulphuric acid and the specific gravity of the electrolyte becomes higher. When the cell has been charged the sulphate of lead has disappeared and volume of acid is greatest. With the discharge of the cell, volume of sulphuric acid decreases and the specific gravity lessens. The fact that lead sulphate has a high resistance and serves as an insulator, should be understood, and that the change of the active materials of the plates from lead peroxide to lead sulphate and from sponge lead to lead sulphate increases the volume, so that too great a degree of lead sulphate might distort or break the plate frame or dislodge the active material.

The voltage of the storage cell is dependent upon the metals constituting the plates or elements and the density of the electrolyte, and the potency of the lead battery is the difference existing between sponge lead and lead peroxide. This difference between the elements in theory ought to be relatively the same until the reduction of the sponge lead and the lead peroxide is accomplished, but practically this is not realized.

(To Be Continued.)

EDISON "IN MEMORIAM."

A Clever Booklet Addressed to the National Electric Light Association.

The Edison Storage Battery Company, Orange, N. J., has published a clever and interesting booklet which is described as presenting facts that did not get into the "proceedings," and containing some of the features of the Chicago convention of the National Electric Light Association, and stories that were told, but not recorded, referring particularly to the Edison storage battery. Usually special booklets are published prior to conventions, but this differs from the general policy regarding publicity and it has been prepared with a view of having sufficient news value to impel the attention of all who shall receive it. The booklet is being sent to every central station in the country and to the personnel members of the commercial section of the National Electric Light Association.

The booklet is admirably arranged and capitally illustrated. It deals briefly with numerous instances of the use of the Edison battery, and brings to the attention of the reader facts relative to service that have been established in a practical way. These statements are equally as interesting to the users of vehicles as they are to central station men because they deal with motor vehicle efficiency and economy. Incidentally the stories as a rule are surprising, though they do not deal with extremes.

An organization of motor truck owners and salesmen is now being perfected in Boston by President D. C. Fenner of the New York Motor Truck Club.

MOTOR TRUCKS FOR ICE HAULAGE.

Extremes of Conditions Experienced in Two Years Contrast the Efficiency of Machines Used by the Providence Ice Company in Regular Service.

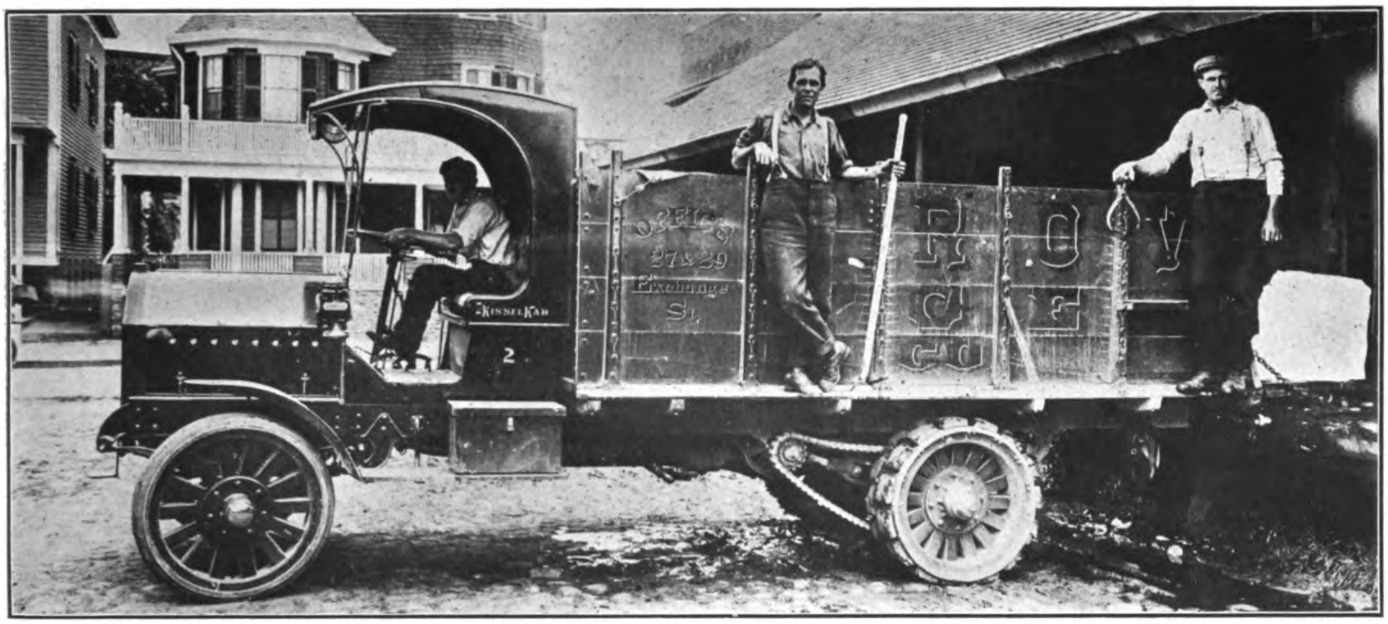
THE sale of ice is a business in which many variables are met with—so much so in fact that those who have the greatest experience maintain that it is absolutely useless to even strike an average and from this attempt deduction as to supply or demand. While this statement will apply to one concern, it is also a fact that conditions will differ in each locality, and it is impossible to find two where these factors may be regarded as alike.

The consumption of ice varies greatly, to be sure, and while there is a limited demand during the cold months of the year the greatest output is in the four months when the heat is intense. Assuming that the quantity used in the summer is 100 per cent. then there is a shrinkage to from 15 to 20 per cent. in the winter. Ice is used constantly by many concerns dealing in perishable goods, or in stock that must be kept at a low temperature, but it is evident enough that the quantity supplied by the ice dealer will vary according to the conditions of the weather.

This condition applies to a greater or lesser degree throughout the country. The demand is lowest during the winter and it increases gradually to the summer and then diminishes. There is, of course, a dependable patronage from the business houses, but practically every dealer in ice regards as the certain source of profit the sales to the families, where ice is delivered regularly and where the price paid is large as compared with the deliveries in what may be regarded as quantities. For instance, 10 cents for a 25-pound piece of ice will yield $8 a ton, and while it costs a considerable percentage of the price to deliver this, and it is necessary to consider many items of expense in computing the net return, there is no doubt whatever that the profit is attractive and sufficient.

Aside from the normal variation of the demand of the constant consumers the family business may be said to begin about May 1 and reach its lowest about Nov. 1, covering a period of about six months. It is not possible for the ice dealer to attempt to do business without adequate delivery equipment, and it will be understood that the requirements are exactly proportionate to the volume of business transacted. In other words, the ice dealer in the northern half of the United States has need of from four to six times as many wagons in midsummer as in midwinter.

But there are years when but little ice is harvested and then the dealer has to meet entirely new conditions. The system and methods that were found satisfactory and economical will not suffice and it is necessary to deal with the business from entirely new angles. This has been the experience of the Providence Ice Company, Providence, R. I., and the fact that but little ice was harvested in Rhode Island last winter has a material influence so far as the service which it is obtaining from its motor trucks is concerned.

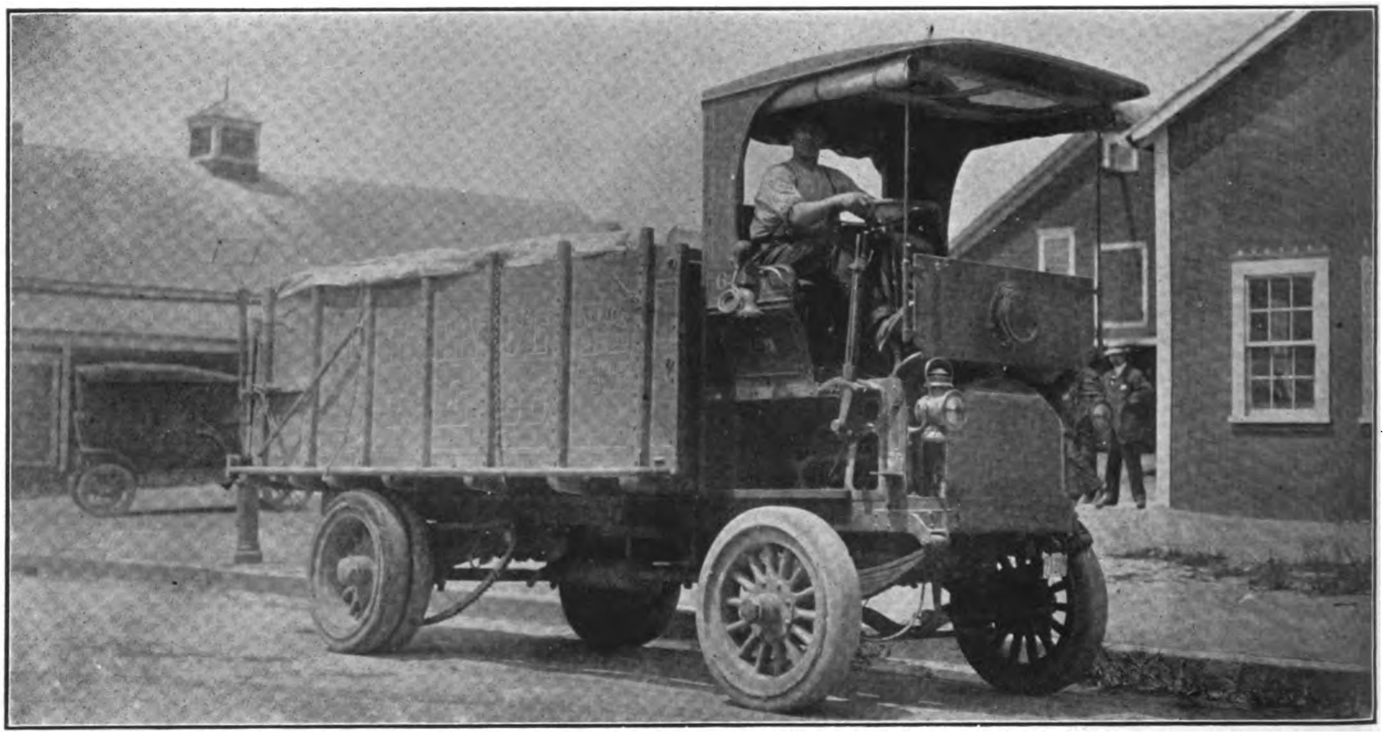


The Four-Ton Kissel Truck in the Service of the Providence Ice Company Unloading Ice at the Burnett Street Supply Station, Hauled from the Railroad Yard.

This company handles about 225,000 tons of ice annually, and the greater part of this is harvested within 25 miles of Providence, usually at large ponds that are convenient to railroads. It is evident enough that if ice were within six or eight miles from the places of distribution and it were necessary to haul it by highway the cost would be much greater than were it

hauled several times the distance by railroad. Not only this, a very advantageous freight rate can be obtained when the contract is made on a basis of 10,000 tons, for instance. For this reason ice is generally harvested where it can be easily transported, and while it is not always practical to have spur tracks to the ice houses, and it may be necessary to haul the ice from the houses to the cars, this is not a condition that materially influences the price.

Some of the ice sold by the Providence company is generally harvested in Massachusetts, and though the bulk of the harvest is obtained beyond a 15-mile radius from the centre of Providence, this is because of the difficulty of obtaining ice nearer. Many ponds are polluted and the ice cannot be used unless for cooling. That is, it is unsanitary for any purpose where it would be brought in contact with food or drink, although it might serve for reducing temperature to preserve perishable goods. There are a number of ponds, however, at distances from the city where it is practical to haul the ice, even though the cost is as much or even more than the expense of securing an equal quality further away.



The Providence Ice Company's Five-Ton Mack Truck, Now in Its Third Year of Service, Used for Haulage from the Railroad Yards to the Supply Stations.

It was the cost of hauling ice from these ponds by horse teams that caused the Providence Ice Company to purchase its first truck in 1911, this being a five-ton Mack machine. The company has stations located about the city and the suburbs, and in the city are the Mashapaug and Wanskuck ponds, where ice is harvested. The ice from the former is used only by packers and for refrigerating. At Knightsville, in the city of Cranston, and East Providence and at Posegansett, in the town of Warwick, are three other ponds and ice houses. At all of these ice houses are stables and from these points distribution is made. In addition there are supply stations at Ethel and Burnett streets in Providence, where there are stables and which are also the central points from which distribution is made in the sections of the city in which they are. In addition the company has supply stations at the railroad yards at Harris avenue and Promenade street, and the ice received in cars is distributed to the business sections of the city.

Normally ice is harvested at Hughesdale, where there are two large ice houses, and at North Providence, where there are two others. The Hughesdale ice houses are respectivly four and 4.25 miles from Ethel street and five and 5.25 miles from Burnett street and Harris avenue. The North Providence ice houses are about four miles from the Harris avenue depot. The greater part of the family trade is ordinarily supplied from Hughesdale ice, which is hauled to Ethel and Burnett streets, and the sections in the vicinities of Knightsville, East Providence, Posegansett and Wanskuck are supplied from those stations. The Mashapaug ice is usually delivered in loads to those requiring large quantities.

The maintenance of the supplies at the Ethel and Burnett street stations was the troublesome problem. It was hauled from the Hughesdale houses by four-horse teams and carts carrying four tons, and two round trips to either station, one to each station, were all that could be done by one outfit. Two round trips to Burnett street were 21 miles, and one to each station 19 miles, or two to Ethel street 17 miles, and it was out of the question to attempt to do more. With the very economical system of maintenance of its equipment, and paying a driver $2.25 a day, the cost of a four-horse team and wagon was figured at $7 a day, and this brought the expense of haulage by animals to

87.5 cents a ton at a very low estimate.

With relation to the North Providence houses the haulage distance is approximately 16 miles for the round trip, and two loads of four tons were the most that could be hauled by a four-horse team and wagon. The cost of haulage was the same, but figured on the basis of ton-miles the expense was greater. These houses were regarded as reserve pure and simple, and though filled each year the ice was often allowed to melt because of the expense of hauling it.

The first year the Mack truck was used it hauled ice from Hughesdale to the two supply stations, with occasional trips to the Harris avenue depot. It was found practical to make five round trips, carrying five tons, or the equivalent of this work, and figuring the cost at $13 a day this made the expense for haulage 53 cents a ton, a saving of 34.5 cents a ton as compared with the horses. Besides this there was the saving of ice, there being a shrinkage of but one per cent. as contrasted with five per cent. with animals, and there was a very large reserve in the truck that was available if needed. The showing made with the truck resulted in the purchase of three KisselKar machines, two four-ton trucks and a 1500-pound wagon in 1912, and these machines were used through the year. The work that was done with the three trucks was largely in hauling the ice from Hughesdale to the Ethel and Burnett street stations and to the Harris avenue depot.

The Mack truck hauled an average of five five-ton loads daily, this giving a total tonnage of 25 for the day and 150 for the week, and this showed a cost of approximately 53 cents a ton, allowing the expense of the truck to be $13. One of the other KisselKar trucks in the same work averaged five trips three days of the week and six the other three, or a total of 33 loads in all with daily tonnage of 20 or 24 tons and a total of 132 for the week. Figured on a daily expense of $12 this made the cost about 54.5 cents a ton. The other truck averaged five round trips daily, with a tonnage of 20 each day and of 120 for the week, and with a cost of 60 cents a ton. The KisselKar delivery wagon was utilized for making special and emergency trips, doing the work of more than three single wagons, being worked every day in the week. Because of the character of the work done with this machine it was impossible to make the same comparison as has been made with the trucks.

It has been the experience of the company that it is not possible to use the trucks for other than supply service or delivery of considerable quantities of ice, and it is evident that there is not a sufficient volume of load orders to justify maintenance of truck equipment for this purpose alone. For this reason such delivery can only be made incidentally. So far as the use of motor wagons for the usual route work is concerned it is not believed by the officials of the company that this is practical. The reason is that the routes are made up with the customers as close as is possible, and much of the time of the driver and helper is taken up by handling and delivering the ice, during which time the wagon is idle. The use of the KisselKar delivery wagon, however, is with sometimes long distances between stops, so that it is possible to realize the fullest benefit of the speed of the machine.

The present year the conditions that might be normally expected have been completely reversed. First of all, but little ice was cut on any of the Rhode Island ponds, either near or distant from Providence, and instead of the company realizing a benefit because of the superiority of the trucks over horses in the haulage from the Hughesdale and North Providence ice houses, and the saving of a very substantial proportion of the cost of transporting the ice from those ponds to the city supply stations, this economy has been nullified by the lack of local ice. Some ice was cut, to be sure, but it was a comparatively small harvest, and practically all of the ice used in Providence has been brought in by railroad, in some instances being hauled several hundred miles.

This ice is received at the Harris avenue and Promenade street depots and these will hold but a small supply. Of course the ice is received daily and is unloaded from the cars at the depots. The trucks are used to haul it from these two depots to the different supply stations, and as the longest haul will not exceed 2.5 miles it will be seen that there is not the economy there would be were there the same mileage necessary as last year. There is a saving in the shrinkage of ice during haulage, and ice is unusually valuable this year. Because of the increased price charged for ice greater economy is observed with its use and there is not the same quantity used as in years when it was less expensive, and this is a considerable factor as well. Naturally the company does not ship any material excess to Providence because there would be more shrinkage in the event of delay and in handling, and why this is so is understood when it is known that a carload of 20 tons will lose sometimes as much as 50 per cent. weight in transit, and the ice is not always in condition to be handled advantageously. Not only this, because of the heavy loss and the high cost at the place of cutting no more than is necessary to meet the requirements is shipped.

The condition limits the tonnage and as the hauls are short it is possible for two of the trucks and the delivery wagon to haul the ordinary daily supply for each station, while one of the trucks is usually kept in reserve and is only utilized in the event of emergency demand or accident. As will be understood from these statements the full economy possible with the trucks is not realized, and this means a proportionate loss when the company cannot use its labor saving equipment.

But there is this fact to be taken into consideration, however, and that is that there is little probability of a season so completely reversing normal conditions being again experienced in a number of years. The same effect may be applied to practically the entire equipment of the company for harvesting and storing ice, for this has been unproductive and has been an ex-

pense from every point of view. The company has its own repair shop, well equipped with machine and hand tools in connection with its garage, and all of the ordinary work is done by the mechanic who has charge of this work. The machines are well kept and deterioration is not permitted. The cost of operation is approximately the figures stated for the four and five-ton trucks, but the expense of the 1500-pound delivery wagon will vary. Not only this, it is impossible to measure the earnings of the machine because special and emergency delivery is represented by pleased and satisfied customers and the retention and expansion of patronage rather than a showing in actual dollars and cents.

The company has experienced a condition that is met with by many others—the difficulty of securing drivers who will handle ice, for many men are inclined to believe that if they drive a machine this is all the work that can reasonably be expected from them, while the drivers of the horses do this work unhesitatingly. If it is necessary to hire men to handle the ice and others to drive the trucks the economy of the machine is nullified by the additional expense.

Another problem that is receiving a great deal of attention is the kind of tires to use to afford the greatest economy. Tires have been purchased up to within a short time with a guaranteed mileage, and it is easy to compute tire cost a mile and a day, but the company has recently made a contract with a tire manufacturer that installs a set of shoes on a machine with no initial charge, and once a month a payment is made for the mileage the tires have been driven during the month. Just how this will work out is somewhat uncertain from the tire manufacturer's point of view, although such a contract is undoubtedly advantageous for the truck owner. As the trucks are loaded to capacity as much of the time as is possible, and for fully 50 per cent. of the distance driven, they are not easy on tires.

Work on the paving of the city streets is undoubtedly more destructive than on the highways, though this condition is generally reversed in winter.

KISSEL MANAGERS MEET.

Annual Gathering of the Branch and Factory Executives Held at Milwaukee.

The annual gathering of the branch managers and the factory executives of the Kissel Motor Car Company, recently held at Milwaukee, was an occasion of unusual interest for all present. The conference afforded opportunity for the company's officials to receive first hand information relative to the conditions wherever a branch establishment is located, and the heads of the branches gained precise knowledge as to policies and the mechanical details of the machines that are now being produced for the 1914 season. Practically all sections of the country were represented and the prevailing opinion was that the outlook was decidedly encouraging.

While most of the managers have been associated with the company for a considerable length of time, few had seen the large auxiliary plant at Milwaukee, which is to be devoted largely to the production of pleasure cars, while the wagons and trucks will be produced at the Hartford, Wis., factory. The works are now producing machines of all types and deliveries can be made immediately.

The Officials and Branch Managers of the Kissel Motor Car Company During the Annual Meeting at Milwaukee, Wis.

The meeting was decidedly interesting, there being thorough understanding of the Kissel selling and service policies, and there was confidence expressed that a large increase will be made in the production and sales. The accompanying illustration shows the following: Left to right, upper row—G. C. Frey, sales manager; J. M. Daggett, auditor; J. F. Lynch, manager St. Paul branch; P. J. Pollock, manager Chicago branch; Paul A. Rix, assistant sales manager; B. M. Linsley, manager Dallas branch; F. B. Hughes, manager Minneapolis branch; T. W. Warner, president Warner Manufacturing Company, Toledo, O. Middle row—Otto J. Koch, Koch Advertising Agency; H. B. Prudden, manager Boston branch; F. J. Edwards, manager Milwaukee branch; C. L. Curtis, manager Kansas City branch; E. Roger Stearns, manager Los Angeles branch; J. J. Kane, Jr., manager Philadelphia branch; H. S. Daniels, publicity manager. Lower row—George A. Kissel, president of the Kissel Motor Car Company; C. H. McCausland, manager New York branch; W. L. Kissel, treasurer of the Kissel Motor Car Company.

Several electric vehicles are now making demonstrations to department stores and manufacturers in Providence, R. I., which are intended to be of a length to give knowledge of actual working results.

SOME INTERESTING NEW DEVELOPMENTS.

A Motor Tractor That Drives with Reins Like a Horse---Single-Bottom Plow for Which Motorcycle Engine Supplies the Power---Orchard Tractor, Etc.

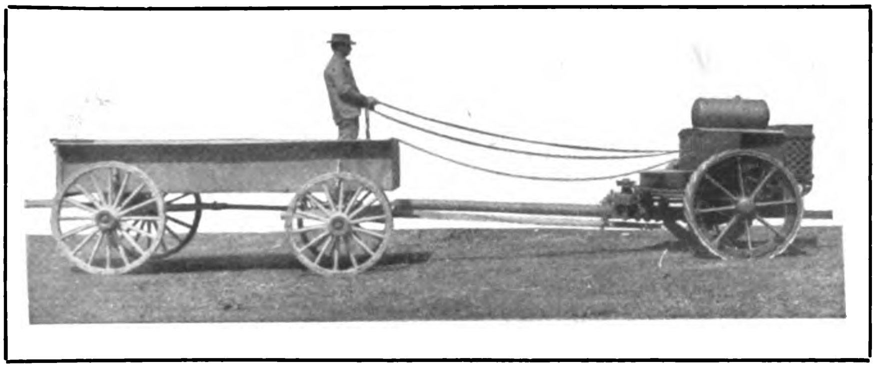
A MACHINE that is distinctive in appearance, at least, is the Detroit tractor, shown in an accompanying illustration. It is stated by the maker, the Detroit Tractor Company, 807 Scotten avenue, Detroit, to be the result of 15 years' experimentation, in which several thousand of dollars were expended in actual field work. For a number of years past machines of this same general type have been built and tested in farm work, until it is believed that the tractor placed in the market is thoroughly practical in every way. The final details of construction are said to have been worked out by an engineer who has devoted much of his life to the designing of machine tools for one of the largest concerns in that line in the world and who is now one of Detroit's foremost automobile engineers.

The object sought in this instance was a tractor that should be adaptable to many different kinds of work in order to take the place of horses and at the same time have the same utility on a small farm as the larger tractors have indicated on the large farms of the West. It is maintained that the Detroit tractor will pull any two-bottom sulky plow, roller, disc, drag, seeder, grain binder, corn harvester, mower, manure spreader and the wagon, and that the changes from one implement to another are easily made. It is also claimed to be a portable engine as well as a tractor, and it is pointed out that it should prove especially useful where the time of loading and unloading is important, as in the lumber yard for instance, and of course it is intended for use in haulage work on the farm, carrying products to market, etc.

As will be noted, the control is effected by means of reins, three of which are held to be all that is necessary, although a fourth is added to operate the brake when the tractor is to be used in hilly countries. Steering is accomplished by a pull on either the right or the left steering rein, which connects the engine by a special friction clutch to the steering gear. A very slight pull is said to be all that is necessary to make a complete turn. A pull on both steering reins simultaneously releases the main clutch in the engine flywheel, thus stopping the tractor. The third rein is used only to shift the gears from neutral to forward or back.

The main frame carrying the engine and gears is a semi-steel casting. The engine is made especially for the Detroit Tractor Company by the Continental Motor Manufacturing Company of Detroit. It is a four-cylinder, four-cycle, water-cooled unit of the L head type, with bore of 4.125 inches and stroke of 5.25, giving it a rating of 27.25 horsepower under the S. A. E. formula. Lubrication is by a positive plunger pump system with constant oil level, all enclosed within the crankcase. Cooling is aided by a radiator of special design, of the vertical fin tube type. Ignition is by Bosch high-tension magneto. The carburetor is designed to vaporize gasoline, kerosene, distillate and low grade fuel oils, although gasoline is used for starting. The capacity of the fuel tank is 30 gallons.

The clutch is a 16-inch leather faced cone, and power is transmitted through direct gears, two spur gear reductions being all that are required between the crankshaft and the driving wheels. A separate oiling system is utilized for the bearings and gears, when the tractor is in motion. The main axle is solid, of 2.5-inch cold rolled steel, and the driving wheels are made with wide flat grouters, which are held not to injure the finest road surface. For field work, detachable cones are furnished, which gives the wheels the proper tractive power in soft ground. Extension rims are supplied when desired. The speed of the tractor is given as from 2.5 to four miles an hour.

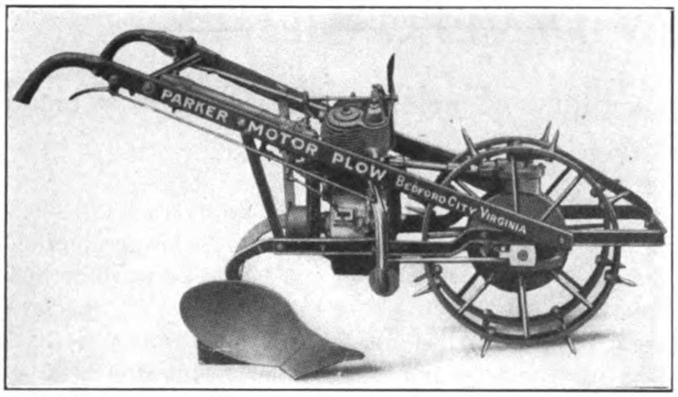


The Detroit Tractor, Steered by Reins, Attached to Farm Wagon for Use on Road.

PARKER MOTOR PLOW.

A Novel Application of the Gasoline Engine to Agricultural Purposes.

Some six months ago reference was made in these columns to a motor operated plow which had but recently made its appearance in England. The machine was designed for use by orchardists and was regarded as a thoroughly practical invention. It appears that long before the British product was placed in the market Joseph N. Parker of Bedford City, Va., who was at that time teaching school, was experimenting with an ordinary plow to which he attached a motorcycle engine. The result of that experimentation has been the organization of the Parker Motor Plow Company of that city, in which the Parker brothers, Joseph N., William A. and Don E., are engaged in the



Parker Motor Plow Utilizes Twin Cylinder Motorcycle Engine.

production of the Parker motor plow shown herewith.

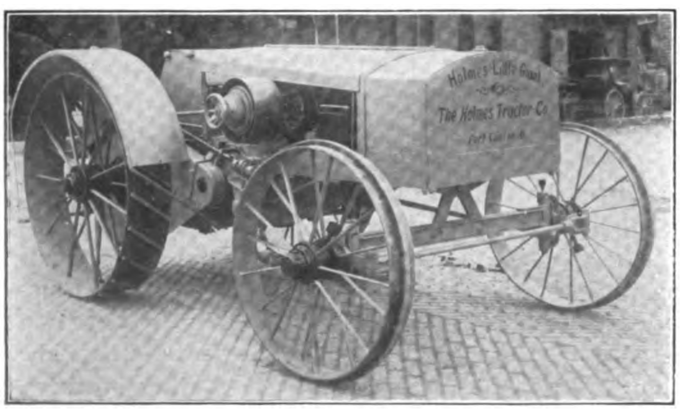
The chief feature of the invention lies in the method of control, the operator walking behind the plow, or harrow, cultivator, wheel hoe, seeder, etc., as when horses are employed. In addition, fittings are supplied with which it is possible to utilize the motor as a stationary engine. The whole equipment is light and easily managed. The control mechanism is located on the plow handle so that it is possible instantly to throw the motor out of engagement, lift the machine over any obstruction and as readily place it in operation again.

The motor is a two-cylinder, air-cooled, nine horsepower motorcycle type and is installed midway between the frame side members over the working attachment. Ignition is by Bosch magneto. This engine drives, by shaft and gear reduction, two spiked wheels. It is maintained that the suction created by the plow holds these driving wheels to the ground and that the spikes prevent them from slipping, thereby enabling the machine to work equally well in sod, soft ground, loam or sand.

HOLMES LITTLE GIANT.

A Tractor Designed to Do the Work of Four Horses on the Small Farm.

Another tractor that is designed for the orchardist, the man with a small farm or anyone who has use for a machine that will do the work of four horses, is the Little Giant, made by the Holmes Tractor Company, successor to the Holmes Manufacturing Company, Port Clinton, O. This concern has been in the manufacturing business for a number of years and in the production of the Little Giant, the use of jigs, templates and micrometer measurements is held to make for interchangeability of parts and easy replacement whenever necessary.



The Holmes Little Giant 12 Horsepower Tractor.

The motor is a Dice two-cylinder, opposed unit, rated at 12 horsepower. The bore of the cylinders is 5.5 inches and the stroke five. Cooling is by water, the capacity of the system being 40 gallons. Lubrication is by mechanical oiler and splash. Jump spark ignition is employed, utilizing batteries and coil. The Schebler carburetor is supplied from a tank of 25 gallons capacity, and the motor is governed to a predetermined speed.

The planetary type of transmission is used, affording two speeds forward and reverse. The low speed is utilized only for starting and turning in close quarters, it being maintained that the machine can be turned in a 24-foot circle. The high, or working speed, is rated at from 1.5 to 1.75 miles an hour. Drive is taken from the transmission to the differential gear by

The Holmes Little Giant Engaged in Orchard Work.

a jackshaft, the final drive being by a chain.

The frame is of steel channel, braced and hot riveted at the corners and cross members. The rear end of the frame, which carries the greater portion of the weight, is spring mounted. The front axle is fitted with the automobile type of steering knuckles and is pivoted at the centre to allow for unevenness of the ground without twisting the frame. The front wheels are 36 inches in diameter with five-inch face, and the rear members 78 inches diameter with 10-inch face. The height over all is 54 inches, width six feet and length 11 feet six inches. The weight, complete, is 4060 pounds.

MOTOKART PARCEL CAR.

Tarrytown Motor Car Company Announces Its First Light Delivery Model.

Interest in the product of the Tarrytown Motor Car Company, Inc., Tarrytown, N. Y., has been awakened because of the wide acquaintance of President A.

Motokart Parcel Car Made by Tarrytown Motor Car Company.

R. Gormully, who was until recently connected with the Maxwell line in the United States Motor Company. The company is now ready to announce its first model, which is illustrated herewith.

The power unit is a two-cylinder, water-cooled motor with bore of 3.625 inches and stroke of four. Cooling is by the thermo-syphon system. The transmission of power is through a friction drive with its unlimited number of speeds, which is expected to make a decided appeal, inasmuch as the vehicle is designed for service where traffic is more or less congested. For this reason, also, the dimensions have been kept down to a minimum, the wheelbase being 65 inches and the tread 44. Suspension is by semi-elliptic springs and wire wheels are employed. The carrying capacity is placed at 400 pounds, exclusive of the driver. The dimensions of the box are 48 inches length, 35 inches height and 32 inches width.

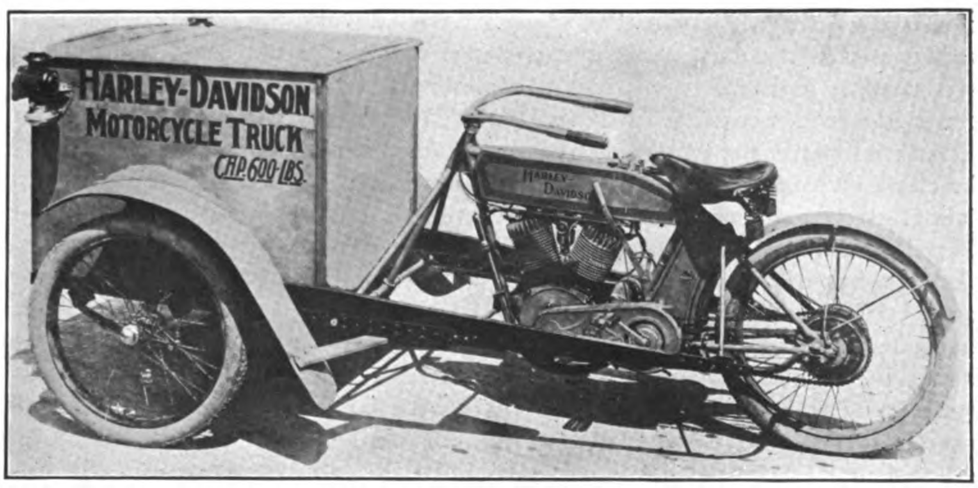
HARLEY-DAVIDSON TRICAR.

Motorcycle Manufacturer Produces Parcel Car Rated at 600 Pounds Capacity.

While a number of the motorcycle manufacturers have produced parcel cars or tricars designed for parcel delivery, the Harley-Davidson Motor Company, Milwaukee, Wis., claims to have carried the matter a step further in its motorcycle truck, so-called, which is rated at 600 pounds capacity. The wheelbase is 76 inches and the tread standard, 56, and several different kinds of bodies are fitted. The standard design, shown in the accompanying illustration, has a width of two feet 10 inches, length of three feet six inches and height of two feet four inches.

Except for the additional strength of the chassis, the construction throughout follows closely that which has proven so successful in the regution Harley-Davidson motorcycle. Among the features, and one which is held to be of decided importance in a vehicle of this character, is the use of the Harley-Davidson two-speed gear, which gives a ratio of 5:1 on high speeds and 10:1 on the low. Another feature lies in the fact that it can be started from the seat without raising the rear wheel from the ground, the engine being started by depressing either pedal, this action imparting motion to the countershaft. Transmission is through the well known free wheel control, used on this make of machine.

Statistics of the manufacture of automobiles, including bodies and parts in the United States for the year 1909 will shortly be issued by the census bureau of the Department of Commerce. This will show that there were 743 different concerns in the classification, but of these only 263 produced complete automobiles as the chief product of value, although they employed more than two-thirds of the average number of wage earners engaged in the entire industry. The total value of products in the year 1909 for the two branches of the industry was $249,202,075, of which $193,023,108 was the valuation of the production of the companies engaged principally in the manufacture of automobiles, and $55,378,967 was the value of the products of the concerns producing principally bodies and parts. The total value of the complete machines manufactured was $164,269,324. There were 126,593 automobiles built in 1909, and all but 23 were built in establishments reporting automobiles as the product of chief value. Michigan was the leading state in the industry with reference to total number and total value of vehicles built. Indiana was second and Ohio third. Of the 743 companies making report 56 reported production valued at more than $1,000,000. The product having the greatest value was the touring car, there being 76,114, valued at $113,403,188, turned out. The report shows that there were, in 1909, 265 establishments employing 58,142 persons (of whom 51,294 were wage earners), using capital of $134,592,965, and paying wages reaching a total of $33,180,474.



Harley-Davidson Parcel Delivery Car, Termed a Motorcycle Truck by Its Maker.

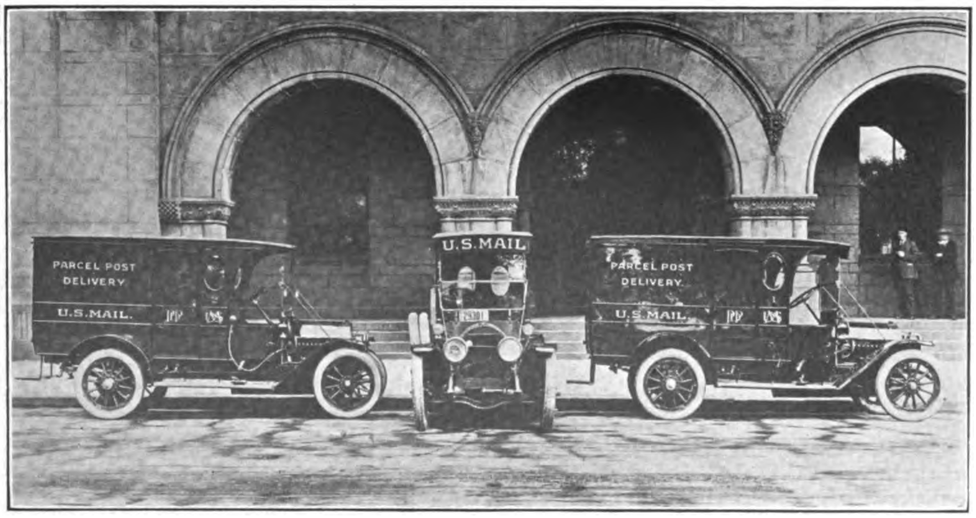
STREET BUILDING WITH TRUCKS.

City of Detroit Utilizes Five-Ton Machines for Hauling Asphalt for Paving.

The department of public works of the city of Detroit, Mich., after a trial of approximately two months, has purchased two five-ton G. M. C. trucks equipped with dumping bodies for use in hauling asphalt that is used for street paving construction and repair. Until May horses had always been used for this work, but the head of the department decided to experiment with motor trucks. Detroit is fairly level and it covers a large area. Many of the streets are asphalted, and because of the large mileage of this paving and the need of maintaining as well as constructing the city has established a plant where the bitumen is heated and prepared for laying.

The asphalt is mixed with material in the proportions for application, and it is carried heated to the place of construction. Asphalt can be handled with dumping bodies provided it is not allowed to cool too low, and as it cannot be heated above a certain temperature it is necessary to handle it as rapidly as possible after loading. When the machines were first tried they were used against horses and in whatever work was undertaken it was the experience that they were cheaper and more economical than animals. This fact influenced the sale.

An example of the work was hauling material from the city's plant at 18th street and Michigan avenue to Palmer street and Second avenue, a distance of about 2.5 miles. The trucks made nine round trips, covering 45 miles, hauling five-ton loads, at a cost of approximately $7.50. This was equivalent to hauling 112.5 tons one mile daily. Besides this there was a great saving in time. To have the asphalt ready for the workmen at 8 in the morning the drivers of the horse wagons reported at the plant at 3 in the morning and left at 4, but the trucks did not report until 6:30 and left at 7:10. By the time the horse carts were ready to return the trucks had reached the first stop at least. The trucks made three times as many trips as the horses and carried twice as much tonnage each load.



Three KisselKar Delivery Wagons Utilized in the Parcel Post Delivery by the St. Paul, Minn., Postoffice.

THE ENTZ ENGINE STARTER.

Electric System Now Produced Suited for Truck and Delivery Wagon Equipment.

The Dyneto Electric Company, Syracuse, N. Y., maker of the Entz electric engine starter and lighting system, is now producing an equipment that is especially suited for service on delivery wagons and trucks. The Entz system consists of a motor-generator and a battery with wiring connection that may be adapted for use on practically any vehicle, the generator serving as a motor to start the engine and then furnishing current for the storage battery from which the energy for lighting is supplied. The motor-generator is mounted on the engine case and is driven by a silent chain, and the battery is installed beneath the floorboards, the control being a switch located on the dash. The combination of starting the motor and lighting is accomplished with but one moving part, this being the armature of the motor-generator. There are practically no automatic controls, the battery being floated on the line and the motor is changed to a generator and back to a motor as the electrical pressure rises or falls above or below that of the battery.

The motor-generator gives its full output when operating as a motor or a generator and the speed is so low that it is permanently geared to the engine at a low gear ratio, and is equally efficient as a motor for starting the engine or a generator in charging the battery and supplying the lights. It generates full voltage at such low speed that no battery controller is necessary to produce a lower voltage for charging than is required for starting. Because of the armature windings it is a generator above a definite speed and is a motor at less than that speed. The electrical connection between the battery and the motor-generator is made with a knife-edge switch located on the dash. Closing this switch, if the motor-generator is stationary, causes the current to pass to it from the battery, starting the engine. After the engine is running when the voltage pressure exceeds that of the battery charging is begun and continued at a definite, governed rate. The construction is designed for installation with practically any form of standard motor, and the starter may be fitted by any practical mechanic without special work, so the cost need not be excessive.

NEW CHASSIS CONSTRUCTION DETAILS.

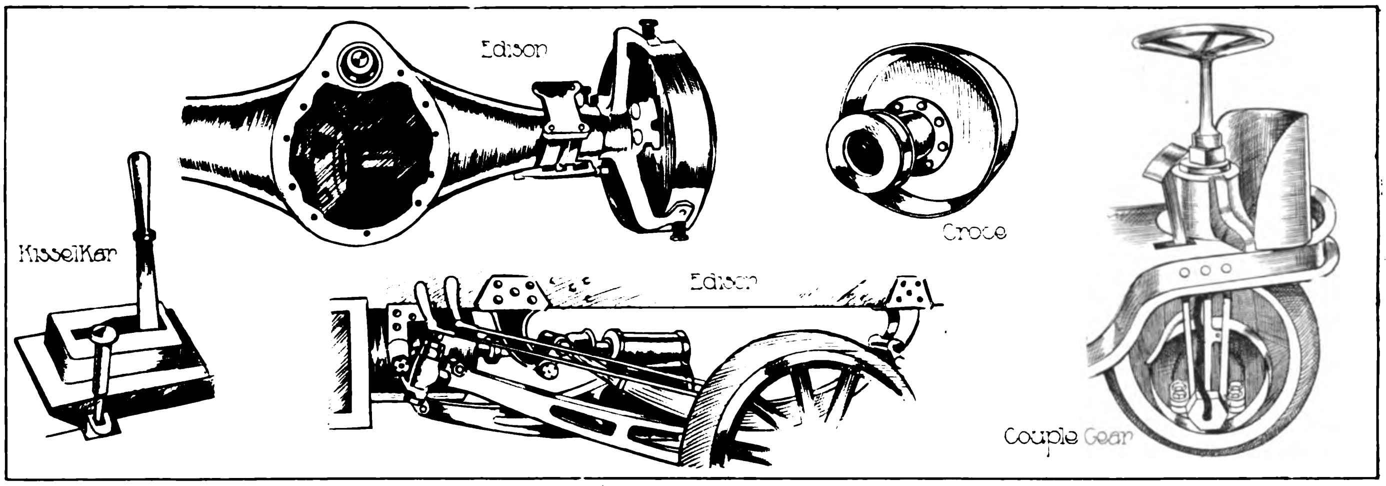
Characteristics of the Eldridge Single Front-Wheel Driven Cart—Features of the Buffalo and Edison Machines and Other of the More Recent Productions.

THE designer who can eliminate a part from a group of chassis components and preserve all the other qualities desired has accomplished what ought to be the chief purpose of every motor vehicle engineer, because simplicity means as a rule greater efficiency, endurance and economy, which may be regarded as the three fundamentals of motor conveyance design. There are, of course, limitations so long as it is believed necessary to preserve principles that were followed mainly because they were convenient in the construction of horse conveyances. In designing, however, there are two factors that usually receive consideration, the one is construction that will endure for practically the life of the machine, and the other is ease of replacement of what will necessarily wear proportionately to the service.

Standardization has generally been with reference to detail, and frequently with a purpose of insuring desired. Because of this character of production it is not possible for the assembled machine to have the individuality that might be found in the vehicle specially designed and built, but these have the merit of being somewhat cheaper, and, assumedly, uniformity of quality so far as workmanship and material are concerned that might not be found in the special design.

Not only this, there are few who realize how expensive a comparatively trifling change in a design may be, which applies particularly to the gasoline vehicle. The electric machine design development is directed more generally toward the elimination of frictional losses and this means high grade material and careful workmanship. There has not as yet been special production of the elements of the electric chassis aside from the motors and batteries.

Probably one of the most interesting creations of the year is the single-wheel driven cart built by the



The Differential Lock of the KisselKar 2500-Pound Chassis; the Rear Axle of the Edison 3000-Pound Wagon; the Motor, Radius Rod, Spring and Torque Arm Assembly of the Edison 3000-Pound Wagon; the Croce Clutch and the Single Front-Wheel Drive of the Eldridge Two-Ton Cart.

interchangeability, but this has not been applied to the principal elements. There is little probability that engineers will agree as to the forms, dimensions and materials, and each seeks to work out his own ideas so far as this can be done, but where parts are designed with a view to manufacturing them for use in practically any machine the necessity of standardizing production is apparent. This may be applied to what is known as the assembled vehicles, where different groups or assemblies are purchased and combined, in some instances only labor being necessary to fit these and produce the finished machine.

It is now practical for the company intending to build a wagon or truck to buy every part and to have these delivered in the original form produced or fitted for assembling, and some very large concerns now manufacture parts that may be adapted, or will furnish, at somewhat increased prices, whatever may be

Eldridge Manufacturing Company, Boston, Mass., which has a capacity of two tons and is intended to do the work for which the horse and cart are now used. Having a radius of movement of approximately 25 miles and being practical for service in space where no animal could be worked, with sufficient power to climb moderate grades when loaded, this machine is regarded as being a distinct advance because it is economical in first cost and its operating expense corresponds very well to the upkeep and maintenance of the animal outfit it is intended to replace. The accompanying drawing gives a clear idea of the construction. The footboard of the "necked" forward end of the chassis frame is a steel plate that supports the bracket or base through which extends the heavy fork that carries the driving wheel, and the fork column is retained in this base by the nut or collar at the top.

There are no springs for the forward wheel, the

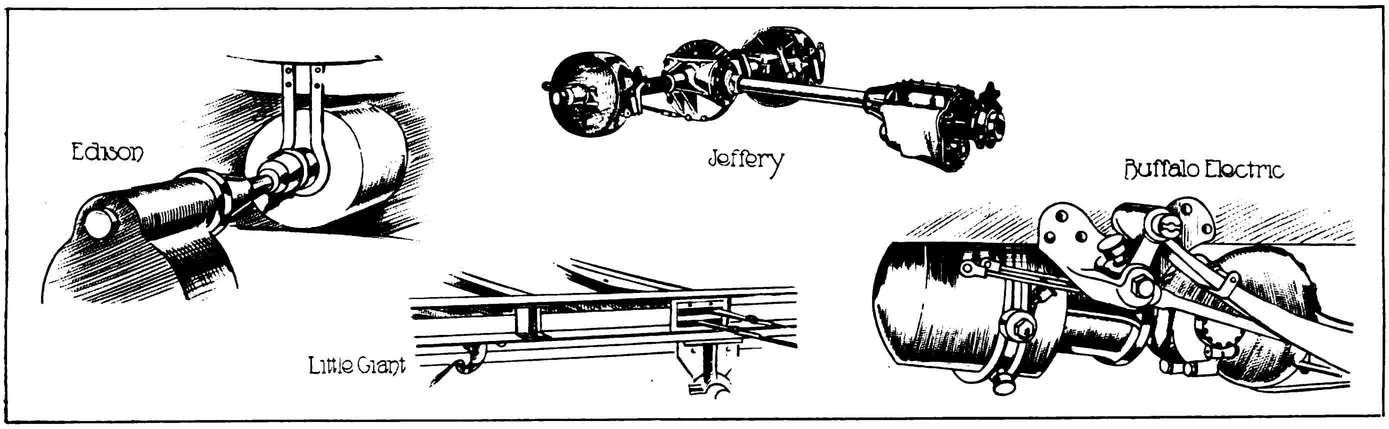
collar above the fork bearing directly against the lower side of the plate. The road shock is absorbed by the large wheel tire, and the driver is protected by a well sprung seat. The fork is a heavy steel forging, the arms being ribbed to insure strength, and in the ends of the arms the axle stubs are fixed. It was necessary to have a special design of wheel, for both wheel flanges contain axle bearings, and both axle stubs are of equal length. These axle stubs are integral with the motor frame, but in the standard Couple-Gear construction the short stub is retained in the outer wheel flange and is covered with a cap. The special wheel has flanges that are practically identical and both have the same bearing on the axle stubs. The weight of the vehicle is carried by the long inner stub with the regular Couple-Gear wheel, but such stress is eliminated, or at least equally distributed on both axle stubs.

Each wheel flange carries a large brake drum and the fork ends are used to support the brake shafts on which the contracting shoes operate, and wire cables permit the free turning of the wheel. It may be swung at an angle of 90 degrees and the cart may be turned in its length. The construction is such that by blocking the chassis frame to its normal height the wheel may be quickly removed should this be necessary, and by the removal of a flange the motor may be exposed for work, inspection being possible through large hand-holes.

There will probably be supposition that the vibration will be excessive as the chassis is carried on a dead rear axle, and the only shock absorbing effect for the entire chassis is the solid rubber tire of the front wheel. The rear wheels are shod with steel tires and the wheels are very large, this insuring a comparatively small current output to obtain tractive effort. As five miles an hour is maximum speed the road shocks will not be as severe as were the machine faster, and the construction so far as the wheel is concerned has been amply tested.

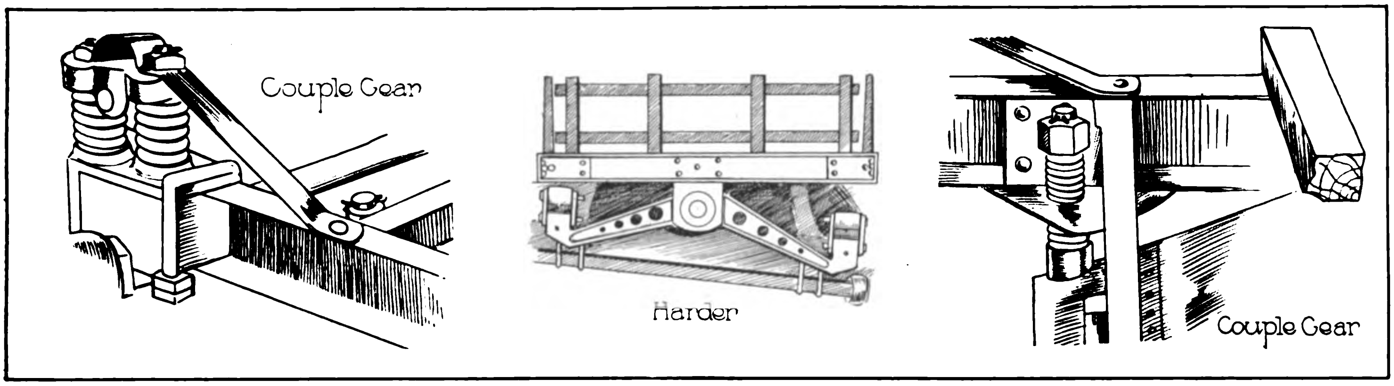
Reference to another drawing of the series that illustrates this article will show the ingenious manner in which the battery is protected against shock and jar, for being a lead type and composed of hard rubber jars a severe jolt might break a cell or one of the straps connecting the cells. The battery box is suspended between the axles and there is a frame below the box to prevent damage should there be breakage of the connections with the chassis. The chassis frame is channel section steel and where the cross members are riveted to the sides are reinforcements in the form of heavy gussets. A large rod extends upward at the corners of the battery box and this is threaded at the upper end. The rods are carried through the gussets and helical springs are placed above and below the plate, the desired tension being secured through a nut holding a collar at the top of each rod. Thus every movement of the battery box is spring resisted and the battery is as well protected as though the frame were suspended in the usual manner.

It is not to be supposed that the loads to be carried will be of such a character that breakage may be feared, but to prevent the noise incident to the jar of a metal body an ingenious device has been developed. The body is supported by a bar or axle beneath it that strengthens the construction, and the ends of this bar are carried in fittings that are centred between two heavy helical springs. These springs are maintained in position by a strap that is carried forward and bolted to the chassis frame, and this is tempered to have elasticity. The springs are seated on blocks bolted to the chassis frame, and the blocks are fitted above the rear axle, stiffening the channel section and preventing buckling under load. When loaded the springs are depressed and load is practically dead, but when light the springs support the body and minimize the rattle and the effect of jar and jolt.



The Motor and Worm Drive of the Edison 1500-Pound Delivery Wagon; the Unit Rear Axle, Driving Shaft and Transmission Gearset of the Jeffery Delivery Wagon; the Truss Frame of the Little Giant Wagons and the Motor, Torque Arm, Radius Rod and Spring Assembly of the Buffalo Wagon.

A Couple-Gear tractor built for a lumber firm is intended to be used with two batteries, the exchange being made at noon. The purposes of this concern could be best served by the removal of the battery and box, instead of removing the trays of cells or a tray fitting into the battery box. The machine is a tractor and the battery is carried above the chassis frame. The edges of the bottom of the box drop below the tops of the frame side members sufficiently to prevent transverse movement and fittings bolted to either end of the swinging gate of the box when secured by a latch prevent the box sliding on the chassis. The device is simple and comparatively inexpensive, while it meets the requirements admirably in service.



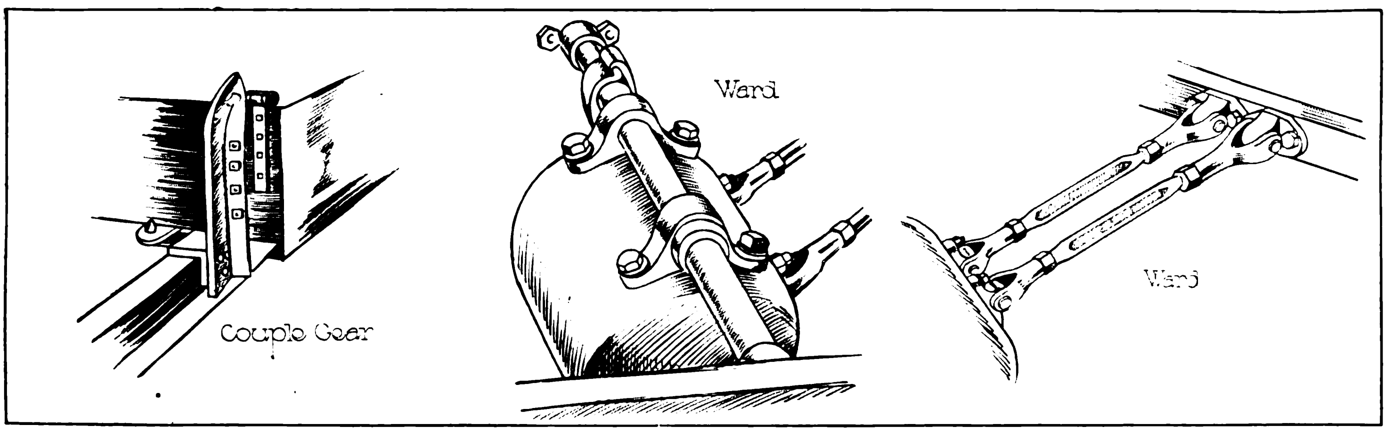
The Helical Spring Body Suspension of the Eldridge Two-Ton Cart, the Yoke Connected Rear Springs of the Harder Truck and the Battery Box Support of the Eldridge Cart.

The Edison Electric Vehicle Company of America builds two machines that have received some public attention, these being of 1500 and 3000 pounds capacity. Both are noticeable from the fact they are worm driven, and it is necessary that these be fitted with specially built axles and torque arms. The smaller machine has no radius rods and is driven through the springs. The motor in this is supported by a U shaped steel strap at the front and rear, and there is one universal joint in the driving shaft, the reduction being through the worm wheel and worm. The shape of the differential housing is unusual and seemingly it is unnecessarily large, but it is a clean casting and is easily accessible. The differential housing carries the rear end of a torque arm that is coupled to a frame cross member beside the motor.

The rear axle of the 3000-pound Edison delivery wagon is a special production and seemingly it is extremely heavy, the cast steel housing having a large diameter to take the worm wheel, while the worm is carried in a casing reached from the front side of the shell. The driving shafts are mounted on bearings of extremely large diameter. With this machine semi-elliptical springs are used and the drive is through radius rods, but there is a large torque arm of a skeleton type extending from the rear axle housing to a frame cross member. In this machine the radius rods are a skeleton type, and have a peculiar coupling at the forward end, a construction that is well shown in the drawing.

The latest type of Ward electric machines uses motors that are suspended transversely in the frame, and these are hung from a large rod on which are brackets that are bolted to the frame of the motor. This construction is not unusual, but because of the drive by silent chain from the motor to the jackshaft it is necessary to have means to preserve its alignment. This is done by the use of two radius rods that extend from the motor frame, being connected about at the line of the armature shaft, to the rear cross member of the chassis frame. The radius rods consist of two forked or yoked ends that are tapped and threaded with right and left threads, and centre sections that screw into these, having a turnbuckle effect, check nuts insuring permanency of position. The yoke ends are securely bolted to lugs on the motor housing and the frame. The double radius rod of the motor is intended to insure against any possibility of twist of the motor, and this adjustment compensates for the wear of the reduction chain from the motor to the jackshaft. Generally one radius rod is regarded as sufficient. Incidentally these rods are very accessible and adjustment can be made with ease.

The motor of the Buffalo electric delivery wagons is constructed with a strap encircling it that carries trunnions at either side. These trunnions are fitted to bearings in a frame that is mounted on a frame cross member so that the motor is pivoted and is free to move on these bearings. The driving shaft is coupled to the armature shaft of the motor, and at the other end engages with a reduction gear from which the driving influence is through a pinion meshing with

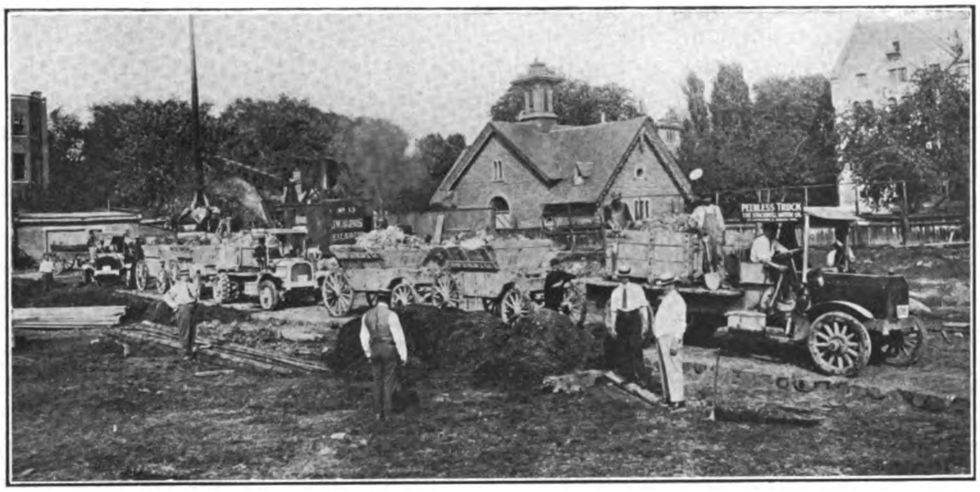


The Battery Box Fitting of the Couple-Gear Tractor, the Motor Suspension of the Ward Electric Vehicles and the Double Motor Radius Rods of the Ward Machines.

the bevel gear of the differential. The semi-elliptic springs are shackled at either end and the drive is through radius rods that are coupled with the spring hangers, this making an extremely simple and efficient combination fitting.

The rear axle, driving shaft and transmission gear-set of the Jeffery 1500-pound delivery wagon is assembled as a unit, this obviating the need of universal joints in the driving shaft, and the forward end of the transmission shaft is coupled to the clutch shaft, the unit having a vertical movement at the rear end from a pivoted connection with a frame cross member.

What is probably the only truss type of frame in a motor vehicle is that of the Little Giant delivery wagons, the side members being formed of steel angles with connecting members at intervals between them the entire length of the chassis. The construction is maintained to afford unusually light weight and to have extreme strength. The space between the upper and lower frame members permits the installation of guides for the brake equalizers, these having especially advantageous location without loss of strength.



A Peerless Truck and Two Trailers Used with Much Success in Construction Work by a Montreal, P. Q., Contractor.

The Harder truck is suspended at the rear on what is practically a platform construction, but instead of the usual cross spring a skeleton yoke is used. This yoke is a steel casting and it is mounted at the centre on a pivot centred in a block bolted to the chassis frame. The ends of the yoke are formed to take the lower bolts of the spring shackles and normally the chassis stands even. When one wheel is raised the yoke swings on the pivot and one spring end is raised and the other deflected, there being no additional stress upon either, while the weight is equally distributed upon them. The result is maintained to be more satisfactory than when a stationary spring is used.

The clutch of the Croce delivery wagon and truck chassis is a cone type that has a sleeve bolted to it. At the rear end of the sleeve are two collars, between which is placed a fork which actuates the clutch. Contained in the sleeve and surrounding the shaft is the clutch spring, and this is adjustable so that any desired pressure may be obtained. The advantage of the design is maintained to be in that it insures freedom from wear and affords ease of adjustment.

One of the features of the KisselKar 2500-pound delivery wagon chassis is the differential lock, which is controlled by a short lever that is moved in a heavy metal fitting secured to the footboard close to the driver's seat. The lever may be moved by the hand or the foot and it may be released by depressing a plunger that is located beside it.

TRUCKS SAVED 55 CENTS A TON.

Experiment in Trailer Haulage Sells Seven Large Peerless Machines to Contractor.

While trucks are not designed to carry more than a given load there is no doubt of the power that may be obtained in useful work, provided, of course, that speed is not the only object sought. Experiments have been made with trucks hauling trailers that have not been productive of satisfactory results, largely because they have not been continued over a sufficient period. Generally trials have been for a short time and under conditions that cannot be regarded as those met with in the average of work.

A Montreal, P. Q., contracting firm recently undertook to test the practical possibilities of trucks with trailers in work in that city, using one and two trailers, these being animal wagons that had been adapted for the service and which were constructed to be discharged quickly. The trains are made up with two trailers, carrying nine tons, 2.5 tons on the truck and 3.25 tons on each wagon, and it was found that the truck could haul the trailers over comparatively rough ground and in soft roads at a satisfactory speed—at least, fast enough to be very economical. The cost of moving excavated material was with the loads described reduced from $1.50 to 95 cents, the comparison, of course, being made with horse haulage. So satisfactory was the trial that the company bought seven four and five-ton trucks and will use them with trailers in excavation work whenever possible, and in other haulage wherever practical.

Several Koehler commercial cars, made by the H. J. Koehler S. G. Company, New York City, have been put to extremely hard tests. The Clinton Hill Lumber Company of Newark, N. J., had a special body built for its machine which enables it to carry long lengths of lumber with the use of a two-wheel trailer. The loads have run into several tons and the car has been in service for nearly a year. A Boston milk dealer has used his machine about eight months and daily carries 2800 pounds of milk over some very rough roads.

TRUCKS FROM THE CONTRACTORS' VIEWPOINT.

THE Motor Truck Club of New York City is one of the most active and energetic organizations identified with motor vehicle transportation. It is composed of men who are associated with many of the companies now producing wagons and trucks, and of those who are engaged in haulage. The club has monthly meetings at which subjects of importance are considered and from time to time men prominent in concerns and associations requiring large transporting equipment are invited to present the "other fellow's view." There is no doubt that the exchange of opinions and experience is distinctly beneficial.

At the meeting of the club the evening of June 25 a paper was read by C. A. Crane, secretary of the General Contractors' Association of New York City, and as this was prepared from the viewpoint of the contractor solely it was of unusual interest. The paper was based upon the supposition that it is necessary for the motor truck salesman to prove the value of the machine to the prospect, and for the manufacturer's service department to work out the problems and to overcome the adverse conditions, it being maintained that this was a custom with manufacturers in other lines with whom the contractors came in contact. The paper follows:

It used to be said that when a man had been a failure at everything else he became an insurance agent. Don't think for a minute that I am so grossly unmindful of your hospitality as to make any invidious comparisons, but countless noble masterpieces of fiction were lost to the world when some of the motor salesmen I have met entered the automobile business! And when we stop to consider the marvelous development of the business—all within the last 15 years—you must admit that it offered an elegant field for the romancer—which was not neglected. I have sometimes given a salesman credit for really believing what he said about a car as long as he was selling that particular make, and I think I am only sharing the general belief in stating that the greatest trouble the salesman had was in filling, rather than getting, orders.

Transportation of all kinds has three stages—the romantic, the useful, the indispensable. Railroads and steamships have demonstrated this. The aeroplane is now in the romantic stage, the bicycle reached the useful, and the motor truck has rendered the automobile indispensable in many lines of business.

But the clever salesman is not content—he knows in his own heart he isn't clever when he sells to a man who wants to buy. It's only when he can sell to the unwilling purchaser that he is entitled to medals, and that's what he is up against—an unwilling purchaser—when he attempts to sell a motor truck to a contractor. You've got to show the contractor, and from my limited knowledge with the contracting business, I'm bound to say you haven't done it.

The contracting business has more peculiar and varying conditions than perhaps any other. There were never any two contracting jobs precisely alike, any more than, as they tell us, there are any two thumb prints precisely alike.

Now I'm speaking of contracting from the standpoint of the contractor—not the material man—for I notice in the announcements published in the motor truck publications that the lists of contractors using this or that motor truck class material men as contractors—and in those lists I have found that of those whom I know, 90 per cent. are material men and not contractors, and I assume that percentage is not far off on the entire list.

The considerations which lead a material man to purchase a motor truck are as different from those which would appeal to a contractor, as are their two classes of business. The material man is governed almost solely by competition; if he can save on haulage he can undersell a competitor. If he doesn't keep abreast of his up-to-date, cost shaving competitors, he wouldn't hold his business, and he must be alive to that fact every minute. With a contractor it is somewhat different—not that competition isn't just as keen—but once he gets the job, the competition ceases for that work. All that remains is to carry out the work as he planned it in preparing his bid, and with the plant he had in mind, and the owner, the party of the first part, pays the price.

Now the bid includes a profit—or the contractor thinks it does when he bids—and barring mistakes or accidents, he will make that profit. You come to him and suggest motor trucks instead of horses. He has figured on using horses and that figure is in his estimate. He doesn't know what a motor truck will do, he isn't in a position to experiment for his contract carries a penalty for delays and overtime. Here's a situation for the clever salesman to convince a man who has a sure thing and nothing to gain but a little more profit, to abandon his plan and perhaps lose all his profit. The superiority of the motor truck over horses is not to be denied by the material man, the brewer, the delivery trades, but to a contractor, live stock is live stock and machinery is scrap.

There is always a good market for a horse. This is one great advantage the horse has over the motor truck. Another is the availability of the horse in many situations where a motor is impracticable. Therefore the contractor must rely to a large extent on horses, and the two methods of power are not adaptable to good team work, as we might call it. Another argument advanced against horses that isn't weighty with contractors is that their use is regulated by weather conditions, and a motor truck is not. If the weather were such that the work were shut down, the motor truck would be idle also, and if it were possible to turn the truck into hauling material, the same is done with horses.

Understand me, I do not contend that the motor truck is not superior to horses for purely delivery purposes, but transportation of material is not the controlling factor in contracting; it is only in a comparatively small percentage of jobs that it is even a considerable factor. The main thing is the disposal and placement of excavated materials; of concrete and the various fabrications that enter into the completed structure. Here in New York in the city tunnel and subway work there are some notable instances of the successful use of motor trucks in hauling away tunnel muck, but it must be remembered that the conditions were ideal for the use of trucks—smooth pavements, and in most successful instances, dumps which were used solely by the motor trucks which permitted of special dumping machinery. In the downtown districts, where the only available dumps are public, they are impracticable for motors because of the long time lost waiting in line with horse drawn vehicles.

I might go on indefinitely citing conditions in the contracting business which operate against a more extensive use of motor trucks by contractors, but I won't tax your good nature. You may have gathered that I am unalterably opposed to motor trucks, but on the contrary, I am a firm believer in them, and I think the reason why more are not used as adjuncts in the contracting field may be ascribed to the methods adopted or the methods omitted by the salesmen and the manufacturer in dealing with contractors.

I am firmly of the opinion that there is a great future for motor trucks in this field, but you are not reaching it by selling a man a machine for $5000 or $6000 and then leaving him alone to experiment with it. It's up to you to do the experimenting—the educating—not the purchaser. For every instance of which I know where a motor truck has given satisfaction I can cite another where it has been a failure—and I am satisfied that it wasn't altogether the truck's fault.

The machinery men who handle contractors' plant follow up a sale and find out if the machine is being properly used—if the machine is the best suited to the particular conditions—and they make it their business to see that it gives satisfaction. They maintain corps of experts who can advise on the best methods of planting a job and handling it—who can design special machinery for unusual conditions. They will install a new device, subject to approval before purchase—and the same methods are necessary on your part. The contractor's problems which can be solved by the motor truck must be worked out by you. You are the people to take the chance—not the contractor—and when the burden of proof is on your shoulders, the incentive will be there to deliver the proof.

Cost data are not convincing. As a matter of fact I am very skeptical of the cost purporting to come from contractors and published in the motor journals. If a contractor has a good thing he isn't going to let the public and his competitors know how good it is, and if he is stung he isn't going to sing about it either. Cost tables won't sell motor trucks, but a plausible idea on their feasibility for handling certain work will interest a contractor. There are a thousand and one details to be worked out. So far only one seems to have been considered—the sale. When some of the others receive your attention the motor truck will be in a fair way to become an indispensable item in the contractor's outfit.

It formerly required five horses to drag a three-ton load up a steep hill leading to the I. Renaud Company's wholesale grocery warehouses at Fall River, Mass. A KisselKar truck, made by the Kissel Motor Car Company, Hartford, Wis., rated at three tons, now does this work at an operating cost of $1.25 a day, and the labor and time necessary have been greatly lessened. This truck, in use since Sept. 1, 1912, has had practically no repairs, while the cost of maintenance has been less than that of one horse.

The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

Entered as second class matter, February 25, 1911, at the Postoffice at Pawtucket, R. I., under the Act of March 3rd, 1879.

LOAD HANDLING FACILITIES.

Probably no greater object lesson as to the necessity of facilities for quick loading can be found than in the majority of the department stores, especially in the large cities. Many of these have admirable equipment for quickly collecting and handling the packages in the shipping rooms, have the vehicles with which they may be rapidly transported between the store and the route, and the trained employees necessary for economic results, but with rare exceptions these stores load their wagons on sidewalks that are frequently crowded with traffic and where the packages must be sorted for the routes and arranged for convenient distribution. This means that the goods must be carried from the elevators along the walks to the wagons and a good deal of time lost in sorting, which includes the time of the vehicles and of the drivers and helpers. Not only this, the shipping is so conducted that the wagons start at approximately the same time, which means loading congestion and the greater number using the crowded elevators and sidewalks, when it would seem practical to load in convenient relays and have as few men and vehicles at the store as were possible.

From an ideal point of view a large loading platform or room would be much the better and far more economical, for if these were of sufficient proportions they could be used for receiving purposes and, even if space that might be used for sales departments were encroached upon, it is practical to attract customers to any part of a store with adequate elevator service, while the shipping room must of necessity be on the ground floor. The delivery service of any store is an expense, and if it can be economized it must by attention to loading, for the unloading must be by the package and to widely scattered customers.

CONGESTION AT TERMINALS.

One of the greatest causes for the loss of the time of men and vehicles is at the receiving and delivering stations of the rail and water transportation companies. Few of these stations are adequate in size, many have but a single platform for incoming or outgoing shipments, and with few exceptions hand trucks are used. There are periods when the workers are frantically busy, while without may be in waiting a large number of men and vehicles. The shippers all want to deliver at the same time, and the others awaiting deliveries are as anxious to receive them. There is no means of knowing how much time will be required to deliver a shipment, for instance, and because of expected delay the vehicles are dispatched with what may be considered ample time to get the freight into the hands of the transportation companies. This further insures loss of time, and with this certainty of waste it is obvious enough that the least expensive vehicle to operate and maintain appeals to the man who realizes that he is compelled to sacrifice time and services.

No matter what the inclination of the shippers or the facilities they have for economic haulage, there can be no improvement so long as the rail and water transportation companies do nothing to facilitate handling of freight. Apparently many of them are wholly indifferent to the cost to their customers. It might be possible for commercial bodies and organizations of shippers to bring about improvement by concerted action and co-operation with the carriers, but this appears to be the only practical solution of the problem.

LIGHTS ON ROAD VEHICLES.

There is no doubt of the need of lights on all road vehicles, no matter where used, as protection for person and property. In several states laws requiring such lighting are in effect. In other commonwealths endeavor has been made to bring about the enactment of similar law, but the bills have been defeated because whatever influence is brought to bear is usually evidenced at committee hearings, and no matter what the attitude of the committee the legislators as a whole must be considered. To secure the enactment of laws of this character it is necessary to create public opinion as to the benefits, which can only be done through constant agitation and concerted effort by all interested. Here is opportunity for the owners of motor power wagons to exercise their influence and bring about good legislation and proper administration of the statutes.

ECONOMICAL LONG DISTANCE MILK HAULAGE.

Five-Ton Alco Saves Owner Between $8 and $9 a Day, Besides Improving Efficiency of the Service---Splendid Growth of Business Results from Progressive Methods.

FEW cities in the country appear to be better able to appreciate the value of the mechanical transport than Springfield, Mass. The visitor who stands on Court square cannot help but be impressed with the varied uses to which motor business vehicles have been put. It claims to be the first city in the country to utilize gasoline driven fire apparatus. The United States mail is collected by a uniformed rider on a motorcycle with van attachment. It almost seems as if every line of business were represented, and nearly all users report decided success. Sometimes this result surprises the investigator, for in other sections certain lines render reports which seem to indicate the impracticability of utilizing motor vehicles because of the conditions surrounding the installation.

The entire plant is as sanitary as it can be made. The stables for the horses are concrete floored with patent gutters, traps and drains for carrying off the refuse, and are separated by a concrete wall from the remainder of the plant. The wagon shed also is concrete floored, sloping in places to drains so that the water used in washing can run off readily. In the rear are the rooms used for separating and bottling the milk and cream, the washing of the cans and the storage of cans and bottles. Adjoining the bottling room is the room where the cream separator is installed, while in the extreme rear are the furnace rooms and garage. Everything that would tend to the elimination of waste movement and surplus energy is utilized, the effect being the maximum of service with

Alco Five-Ton Truck Utilized in Long Distance Milk Haulage, in Front of Charles A. Nash's Bottling and Distributing Plant on Oakland Street, Springfield, Mass.

the minimum of effort. In the near future it is proposed to add machinery for pasteurizing, clarifying, refrigerating and bottling, and a greatly improved separator.

Perhaps Springfield has better means of solving the difficulties presented, or it may be that the more general application of the mechanical transport carries with it features which render the problems less acute.

Many Springfield men are free to attribute their business success to the use of motor vehicles. This is in a large measure true of Charles A. Nash, a milk dealer located on Oakland street. Five years ago his business of supplying families with bottled milk was handled by three one-horse teams. Today, seven such wagons distribute 3300 quarts of milk and 125 quarts of cream daily. The business employs 17 people, including drivers, barn men, bottling men, helpers and office clerks.

It must not be presumed that this splendid increase in business and the facilities with which it is handled are entirely due to the use of a motor truck, but Mr. Nash is using a five-ton Alco, made by the American Locomotive Company, New York City, and purchased through the Morse-Readio Company, the Springfield agent, with the result that he is saving between $8 and $9 a day in the handling of the milk. Moreover, he has been able to increase the supply of milk received each day through his ability to handle the

product more directly and in much less time.

Springfield has a population of 88,926, according to the census of 1910. The cities of Holyoke, with 57,730, and Chicopee, with 25,441, virtually are a part of what might be termed the "metropolitan district" of Springfield, and to these figures must be added 9224 for the town of West Springfield. Statistics are not available for the towns of Longmeadow and Ludlow, which add perhaps as many more. Westfield on the west, with 16,044, and Palmer on the east, with 8610, also must be supplied with milk from the agricultural district immediately surrounding Springfield. This presents a total of between 200,000 and 225,000 people who make up the market for milk producers in that section, and explains the necessity for bringing the milk a long distance.

Practically all of Mr. Nash's supply comes from the farms in Gilbertville and Old Furnace, in Worcester county, the former being approximately 33 miles from his plant on Oakland street. Before he purchased the Alco truck he was dependent upon the railroad for haulage, and two receiving stations were established, one in Gilbertville and the other in Old Furnace. The farmers delivered their milk at these stations early in the morning, whence it was picked up by the train men and brought to the freight house in Springfield. It then became necessary to cart the milk from the freight house to Oakland street. At first this was done by teams, but later it was found more advantageous to arrange for this work by contract.

None of the milk is delivered to the customers until the morning following its arrival in Springfield, but the necessity of bottling, etc., make it extremely desirable that it should be at the plant as early as possible after its arrival in Springfield. Since the railroad handled all manner of freight, the arrival of the milk was dependent more or less upon the amount of business picked up by that train on its way from Athol. In the effort to expedite matters an express man was employed who utilized a motor truck, and it was while engaged in studying the work done by this vehicle that Mr. Nash became interested in the possibilities of motor truck delivery direct from the receiving stations in the country.

After investigating the various makes available, he decided upon the Alco, to which he fitted a specially designed body, capable of carrying the cans in two tiers. As will be noted by the accompanying illustration, the entire load is protected from dust and dirt, and in a measure from the heat of the sun, by a canvas covering. The milk is loaded ice cold, and the run from Gilbertville to Springfield is made in from four to 4.5 hours, so that the temperature has risen but little upon its arrival. The truck is fitted with dual block tires in the rear and solid rubber tires in front.

The Seven Single-Horse Teams Which Comprise the House-to-House Delivery System Employed by Charles A. Nash.

One man leaves the Oakland street plant with a truck load of empty cans at 4:30 every morning, Sunday included, driving directly to Gilbertville, 33 miles. Here he finds the farmers awaiting his arrival, and they assist him in loading the milk, so that the wait at Gilbertville averages about 20 minutes. The larger portion of the load is picked up at this station, after which there is a drive of 4.5 miles to Old Furnace. The road over this portion of the journey is not especially good, although it averages well with the old country ways of the district. Other farmers are waiting at Old Furnace and the stop there does not exceed 15 minutes. Then begins the journey of 28.5 miles to Springfield, most of the way being over state macadam, except for three or four miles beyond Ware, which is in much the same condition as the 4.5 miles previously mentioned. The truck arrives at Oakland street between 1 and 1:30 in the afternoon.

The full cans are immediately unloaded and taken into the large, concrete floored bottling room, where

the racks of bottles, which previously have been washed and sterilized, are already in place on wheeled hand trucks. As fast as the bottles have been filled they are immediately taken to the ice chests, so that the temperature is not permitted to change more than is absolutely necessary. That portion of the load which is destined for the separator, in order to produce the daily allowance of 125 quarts of cream, also is handled as expeditiously as possible. Everything is in readiness for the drivers long before they start out on the delivery trips the next morning. The main object of the plan is to handle the milk quickly, particularly in warm weather, so that it shall be cooled properly at all times, and in this respect the use of the motor truck is of decided advantage over the older method of handling by railroad train men.

Mr. Nash has kept careful account of the expense, it being recognized by him that each department of the business must be managed as economically as possible, consistent with protecting his customers. The truck uses an average of 19 gallons of gasoline and three quarts of oil a day. The tires are purchased on a guarantee basis, the rear members being guaranteed for 8000 miles and the front for 10,000. Actual experience has indicated that in this work, over the roads traversed, which are by no means ideal in places, as has been explained, the block tires will average 3500 miles and the solid members on the front a little better than 4000, before being regarded as unsuitable. While Mr. Nash does not care to go into details concerning all of the items in the truck's expense account, he states that it totals between $12 and $13 a day. This includes an allowance for depreciation and interest, and the driver's salary of $21 a week, but no provision for garaging or repairs. The machine is garaged on the premises at the Oakland street plant, and thus far there has been no expense for repairs or replacements.

Under the old system Mr. Nash paid a freight charge of five cents a can each way, besides employing the contractor to haul the milk from the freight house to the Oakland street plant. The total expense averaged about $21 a day. This was for cartage alone. The necessary delay in receiving the milk and the impossibility of arranging to care for it at a stated time were responsible for some overtime work, the expense of which should be added to this figure. And, of course, the inefficiency of the system cannot well be reduced to dollars and cents.

Although Mr. Nash has found this truck a decidedly successful investment, he does not believe that motor vehicles ever will entirely displace horses in the milk business. He does not see how any car, operating either with gasoline or electricity, can compete with a horse and wagon in house-to-house delivery, for the reason that horses in this work soon learn to cover the route, so that the driver is able to take, say half a dozen bottles of milk and visit as many houses to come out of the last one and find the team waiting for him. With the automobile he would be compelled to return to the starting point each time.

TRUCK DIVES INTO MILL POND.

KisselKar Brewery Machine Plunges from Stone Wall and Is Little Damaged.

When a two-ton KisselKar wagon in the service of the Joseph Schwartz Brewing Company, Hartford, Wis., plunged from a 10-foot stone wall into the bed of a mill pond in that city it demonstrated the construction of the machine in a manner that was as surprising as it was convincing. The "header" was a drop into shallow water and the machine brought up with the front wheels resting on the bottom and the rear wheel on the edge of the wall, the jackshaft being partly on the stone.

Two-Ton Kissel Truck After It Had Battered Down a Stone Wall and Plunged Into a Mill Pond, with a Flattened Muffler and Bent Running Board as the Only Damage.

The truck was seen by hundreds and there was general belief that it was hardly worth a tenth part of the purchase price, but a derrick was obtained and after a couple of hours' work the supposed wreck was hoisted on to the road. When examined there was much astonishment in the fact that aside from a badly bent mudguard and a crushed muffler the machine was not damaged.

This opinion was, moreover, established when the afternoon of the same day it was sent to the brewery and went out on an 18-mile trip. In further service there developed no weaknesses which were considered as due to this accident.

LONDON MOTOR OMNIBUS SERVICE.

THE omnibus service in London is the largest in the world. The city has a very large part of its streets well paved and the service given is unequalled in any other city. The following review of the service and of the vehicles used was given by President T. B. Browne, of the Institution of Automobile Engineers of England, in an address made by him at the recent midsummer meeting of the Society of Automobile Engineers:

The motor omnibus seems to have made comparatively little headway as yet in this country and I have therefore thought that some details of the large and efficient motor omnibus service of London may prove of interest to you. According to the figures furnished to me by the courtesy of the commissioner of police, the number of motor omnibuses licensed during 1912 for use in London was 2908, so that with the subsequent additions there are now more than 3000 of these vehicles in use in the metropolitan area, as compared with about 1000 in Paris. It may be of interest to state here in passing that there are over 8000 motor cabs licensed in London alone.

The whole of the petrol propelled motor omnibuses running in London are now either owned or controlled by the London General Omnibus Company, and its subsidiary companies, including the Stevens-Tilling petrol-electric vehicles which I shall describe later. The only independent company is the National Steam Omnibus Company, who construct and run the highly successful vehicles designed by one of our members, Mr. Thomas Clarkson, who is giving a paper devoted to them before this meeting.

The first requisite for the successful use of motor omnibuses in competition with street tramcars is, of course, good roads, and in this qualification London and its environs are now second to no other town and it is largely owing to this that the motor omnibuses have been able to compete so favorably with the electric trams or trolley cars as you call them here.

Two main factors have principally conduced to the present efficiency of the petrol omnibuses as now running on the London streets and these are firstly, the insistence of the police authorities that the vehicles should comply with a high standard of noiselessness and reliability combined with a low maximum weight limit, and secondly, the determination of the constructors to produce vehicles capable of passing these tests. As an example of the difficulty of passing the police inspection of these vehicles it may be mentioned that cases have been known where vehicles have failed to obtain a license to run solely on account of the hissing noise caused by the passage of the air through the carburetor inlet, great trouble being caused by this defect alone until a suitable carburetor was discovered.

The police regulations as to weight, which are strictly adhered to, include the following maxima:

Complete omnibus, unladen	7,840 pounds
Back axle weight, laden	8,960 pounds
Front axle weight, laden	4,480 pounds
Total weight, laden	13,440 pounds

The last three figures include an allowance for 16 inside passengers and 18 outside, as well as the driver and conductor, of 140 pounds each. As regards dimensions, the total length must not exceed 23 feet and the breadth seven feet two inches at any part, the maximum wheelbase being 14 feet six inches and the wheel track or gauge not less than five feet six inches. There are also many other arduous but necessary regulations as regards brakes, steering gear, the prevention of smoky or otherwise offensive exhaust and leakage of oil from engine and transmission cases. Supporting bars have also to be fitted to minimize risk of danger from broken or falling parts such as cardan shafts and there are many strict rules as regards dimensions and other details of the body, also in reference to lighting, prevention of rattling, etc., etc.

It may be well to point out that at the present time there are still a certain number of the most successful of the older types of motor omnibus running in London which do not in every way comply with the latest regulations as regards the present weight limits which they slightly exceed, but it has been the policy of the police not to deal harshly with the owners who have already received licenses for these vehicles under earlier regulations. The vehicles still running under this category belonging to the London General Omnibus Company, include 118 De Dions, having spur and bevel transmission and cardan shaft drives to the rear wheels, also 60 Straker Squires with chain driven, change speed gears, the power being transmitted to the road through worm gear and final chain drive. Besides these there are some Leylands with spur change speed gear and final live axle worm drive.

The chassis which has been specially designed by the London General Omnibus Company and has stood the test of the strenuous regulations mentioned above is known as the B type. Of these some 2200 have now been constructed and put on the road and their reliability is shown by the charts giving the percentage of involuntary stops and those ordered by the police. The total distance covered by the London motor omnibuses a month is now averaging over 8,000,000 miles, the total miles lost from all causes by the B type vehicles for March last being 0.136 per cent. of the total possible mileage. The involuntary stops from all causes a 100 miles was 0.012, or say 12 stops for every 100,000 miles. In 1912 the total number of omnibus passengers carried in London was 492,858,934. Before starting to build its own chassis some 32 different kinds of motor omnibuses had been tried and used by the London General Omnibus Company, including petrol-electric, steam and petrol. Undoubtedly, one of the principal factors which have led to the successful results achieved has been the undertaking of the construction of the vehicles by the actual users, as in this way there is no clashing of interests between maker and user in tracing and removing defects and the experience gained in running and maintenance has been most valuable in arriving at the most suitable methods of design, construction and also in the choice of material.

A close alliance of this nature exists in every case where success has been attained, namely with the London General Omnibus Company, the National Steam Omnibus Company and the Tilling-Stevens system.

In the case of the London General Omnibus Company, nearly 400 motor omnibuses have been supplied by the Daimler Motor Company, but these vehicles are a development of the B type mentioned above and the most important differences between these two chassis are mentioned later. The London General Omnibus factory at Walthamstow, which is capable of an average output of 30 vehicles a week, as well as supplying renewal parts for 2500 motor omnibuses, is one of the best organized in the British Isles, and has been laid out especially for the production of the one type of chassis with the consequent economy in the cost of production. The Daimler company have also organized a special department of their factory for turning out 30 omnibus chassis a week.

I have not time here to deal with the wonderfully efficient organization for the running and maintenance of the motor omnibuses and it must suffice to say that there are 35 garages with fully equipped repair departments attached, situated in convenient parts of London, controlled by the London General Omnibus Company alone.

It will now be interesting to see in what way the various defects in the earlier vehicles have been overcome in order to comply with the stringent police regulations already mentioned.

Owing to the courtesy of Mr. W. J. Iden, chief engineer of the London General Omnibus Company, I am enabled to publish for the first time drawings showing details of the B type chassis as constructed by that company. It will not be necessary to describe the various parts in detail, so that I propose only to touch on the points which are of particular interest as illustrating the special requirements for an omnibus chassis as distinct from a lorry chassis designed for the same load.

One is at once struck by the comparative slenderness of the main members of the frame, the longitudinal members of which consist of 1.75-inch thick ash on either side of which are riveted .1875-inch nickel steel plates. These side members are of uniform depth for about half their length from the rear, the depth of the forward half being increased as shown. Although the average life of most of the parts of the B type vehicle is now known to its constructors, that of the frame has not yet been ascertained as none has yet had to be scrapped.

To account for this it must be remembered that the body which consists of an extremely rigid box-like structure is bolted to the frame and therefore acts very much as a stiffener to it. This combined wood and steel frame is said to be much superior to a pressed steel frame in reducing the noise from the transmission as heard inside the omnibus.

Another notable feature of the frame is its height from the ground, namely, two feet 10 inches at the upper surface and well above the average height for motor vehicles. The main reason for this is to obtain a straight through horizontal drive from the crankshaft to the worm driven live axle and at the same time to provide the ample clearance under the vehicle as insisted upon by the police. The diameter of the driving wheels is also a factor here.

One of the special features of the engine is the system of lubrication employed for the connecting rod big ends. This consists of troughs into which small scoops attached to the connecting rods dip when at their lowest point and so pick up the correct amount of oil. Since this system has been adopted, all trouble from smoky exhaust has disappeared. One of the main differences between the London General Omnibus and the Daimler engine is that poppet valves are used for the former while the latter uses a Knight sliding sleeve valve motor. With this engine it has been found advisable to arrange for the troughs to be slightly raised or lowered with the throttle so as to vary the amount of oil supplied with the M. E. P. All engine bearings are of white metal and the main bearings are lubricated under pressure by means of a rotary pump.

The dimensions of the London General Omnibus engine are 115 mm bore by 140 mm stroke, the Daimler engine being 110 mm bore by 150 mm stroke. Both engines have their valves actuated by saw-tooth chain drive from the crankshaft and are not fitted with governors, the throttle being controlled by a pedal. The various pipes on the engines are made up from steel stampings in two halves which are welded together and have the flanges attached by the acetylene process, and are then lead coated inside and out, which makes a very quick, clean and economical job.

The poppet valves of the B type engine have recently been enlarged from 36 mm to 42 mm. These valves are now made from mild steel and are case hardened and ground all over.

Formerly they were made from 10 per cent. soft nickel steel and only hardened at the tappet end so that the stem wore and caused leakage of air between them and the inlet valve guides, which upset the carburetion and created a spitting noise by the escape of the exhaust in the same way. The London General Omnibus Company relies on thermo-syphon for water circulation, but the Daimler company prefers to use a rotary pump. Both now use the same pattern radiator, which consists of vertical copper tubes, the ends of which are expanded and soldered into the top and base tanks of the radiator. Bosch high-tension magnetos are used on all engines. The magneto is enclosed in an aluminum case which the driver is not allowed to touch.

The carburetor is of the two-jet type, the main jet being fitted in the centre of the choke tube in the ordinary way, and the auxiliary jet in the centre of the float chamber. The throttle valve is hollow and the centre chamber thereof is connected by a small passage to the auxiliary jet, so that when the valve is almost closed for slow running the main jet is cut off and gas passes through the centre of the valve from the auxiliary jet, the air passing through a ball valve. Cold air comes in to the main jet from the bottom of the carburetor and hot air through the pipe shown on the left. With this carburetor the petrol consumption varies from seven to 10 miles a gallon according to the nature of the route on which the vehicle is run. The clutch is of the ordinary leather cone type.

The universal joints connecting the engine with the gearbox and the gearbox with the worm drive live axle are of special design and are fitted with ball bearings to save wear on the moving parts which, if plain bearing surfaces are used, are liable to rattle badly as soon as slight wear occurs. The Daimler company has been experimenting with a type of universal joint in which leather discs are employed to take the drive, the variations in the relative position of the two shafts being compensated for by the flexibility of the leather. This type of joint is, of course, not new as applied to fixed plant, but is novel as regards its application to automobiles. I understand that its behavior has been such that it is likely to be adopted as standard practise for this type of vehicle by the Daimler company. It is certainly cheap and simple to manufacture.

The greatest difficulty in connection with the reduction of noise has been experienced with the change speed gear. Extensive experiments have been carried out in the endeavor to minimize the sounds emitted by the indirect drives of the gears. The solution has been found by entirely replacing the spur wheels except in the case of the reverse, by silent sawtooth chain drives. These have proved to be quite satisfactory in every way in spite of the fact that the chain makers themselves were very pessimistic as to their use. The salvation of the whole arrangement is the shortness of the chains, so that with the few links employed the total stretch of the chain with wear is very slight.

For some time great trouble was caused by the leakage of oil onto the roads from the crankcase, gearbox and worm gear case. It became necessary, in order to comply with the police regulations, to cast troughs below the joints to catch the oil which escaped from them. The joints were made as tight as possible by the use of brown paper, but the mechanics when overhauling the chassis often displaced the paper, so that leaky joints were rather the rule than the exception. This objection has now been entirely overcome by having the joints carefully scraped up by hand and then fitted together without the intervention of any joining material.

The B type has a worm driven live axle. Until recently it was generally considered that worm gearing could not be made to run at anything like the efficiency of bevel gearing and so it was used by only a few firms on account of its silent running, but recent experiments at the British National Physical Laboratory and also by Brown & Sharpe, have shown that by combining careful design with accurate workmanship and ball threads of ample size an efficiency as high as 95 per cent. can be obtained in actual practise; and so we find that all the motor omnibuses of recent design now running in London, including petrol, petrol-electric and steam, are fitted with worm driven live axles. Only the survival of the fittest can decide whether the Lanchester hollow worm or that of the straight pattern is superior. At present the former is only used on the Daimler 'buses of which there are now nearly 300 running in London under the control of the London General Omnibus Company. With the straight worm the double thrust can be fitted at one end to allow for expansion and contraction caused by temperature variations, but with the hollow worm they must be fitted at opposite ends to keep the worm in its correct relative position to the worm wheel. The axles of the two types are very much alike, the sleeves being bored from the solid. The Daimlers have hollow worms, giving a reduction of 7.25:1 and splined keys are used wherever possible instead of single loose keys. The B type axle has straight pattern worm gear with a reduction of 7.33:1, the worm having three starts and the worm wheel 22 teeth. In both types the complete worm gear is held in bearings fixed to the upper part of the axle casing, which can be entirely removed with the worm gear by taking off a few bolts, the shafts from the differential to the wheels being inserted from the outer ends of the sleeves. The live axle is designed so as to be easily removed from the chassis and an axle has been changed on the road in 45 minutes. The Daimler company uses roller bearings on both axles, the London General Omnibus practise being to use plain floating bushes of phosphor bronze.

The road wheels are made from special steel castings with hollow spokes; the weight of the rear wheels without tires is under 200 pounds each, that of the front wheels being under 100 pounds, including hubs and bushes. Various kinds of solid tires are used and are supplied by the tire makers, who guarantee the mileage, which averages about 20,000 a set of tires, the cost being about one penny a mile. Twin tires are used on the rear wheels and single tires on the front wheels, the standard dimensions being as follows: Rear wheels, twin tires, 100 mm by 1000 mm; front wheels, single tires, 120 mm by 900 mm. These dimensions are practically limited by the maximum weight allowance as fixed by the police and it is probable that greater economy in wear of the tires would result if larger tires could be used to relieve the transmission of all braking stresses. Both foot and hand brakes are situated on the rear axle and are actuated by expanding shoes inside drums bolted on the rear wheels.

A point of interest about the springs is the auxiliary volute spring fitted to the rear axle, so that it only comes into action after the leaf springs have taken about 70 per cent. of full load in the usual way. The addition of this volute spring has added very greatly to the comfort of passengers, as it has overcome the difficulty of providing correct suspension for both a full and empty omnibus.

Throughout the chassis it has been necessary to use extremely high grade materials to keep within the weight limit and comparatively few iron and steel castings are used, the complete list of these being the cylinders, road wheels, brake drums, steering box (two pieces), back axle casing, worm casing, two spring carriers and the exhaust branch from the engine, which cannot be made from a steel stamping owing to warping due to high temperature. The steel stampings used comprise the flywheel, all frame brackets, including change speed and spring brackets; also the halves of engine pipes mentioned above.

As mentioned above there are about 120 petrol-electric motor omnibuses running in London constructed on the Stevens-Tilling principle, in which the transmission from engine to the worm driven live axle is by an electrical set, consisting of a compound wound dynamo, direct coupled to the engine, and a series wound motor coupled through a cardan shaft to the worm.

The engine has four cylinders, 105 mm bore by 125 mm stroke, cast in pairs, high-tension Bosch ignition, a Solex carburetor and the trough system of lubrication being used. The dynamo is connected direct to the engine by means of a flat leaf spring coupling, no friction clutch being used. No electric circuits are made or broken when driving, as the dynamo is designed to cease to excite when its speed falls below 300 revolutions a minute, so that by nearly closing the throttle, which is effected by releasing the throttle pedal, the torque of the motor is reduced to zero.

The dynamo is capable of maximum output of 20 kilowatts at a speed of 1400 rpm, with a maximum e.m.f. of 300. The control is effected entirely by the gas throttle pedal, except when ascending very steep hills, in which case a shunt resistance contained in the controller box is employed to allow of increased engine speed. The dynamo and motor are of the semi-enclosed type and are ventilated by a disc fan carried on the rear end of the dynamo shaft, which as well as the motor shaft is carried on ball bearings. The efficiency of the dynamo is given by the makers as 90 per cent. and that of the motor as 88 per cent., making a total of 79.2 per cent. efficiency of the electrical set.

The average running costs of these vehicles as supplied by the makers is given as just over 7d a mile and the author is of the opinion that this would be just about on a par with those of the London General Omnibus Company, but as the figure for running these vehicles has not been published this cannot be regarded as anything more than a guess.

The Paris omnibuses have developed on entirely different lines from those used in London and are of the single deck type, constructed to take from 30 to 35 passengers, with the driver's seat situated on top of the engine. A spur gear change speed box, having three forward speeds, is used in conjunction with a bevel gear from which the power is transmitted through cardan shafts and internal spur gears on racks to the driving wheels, as it is not practicable to obtain the reduction required in a single bevelled pair. The motor used in these vehicles has four cylinders, 125 mm bore by 140 mm stroke. The tires used are 140 mm by 900 mm single on front wheels and 160 mm by 950 mm twin on rear wheels. The weight of the chassis is 3350 kilograms; the weight of complete vehicle empty, 5100 kilograms; the weight of complete vehicle full, 7800 kilograms.

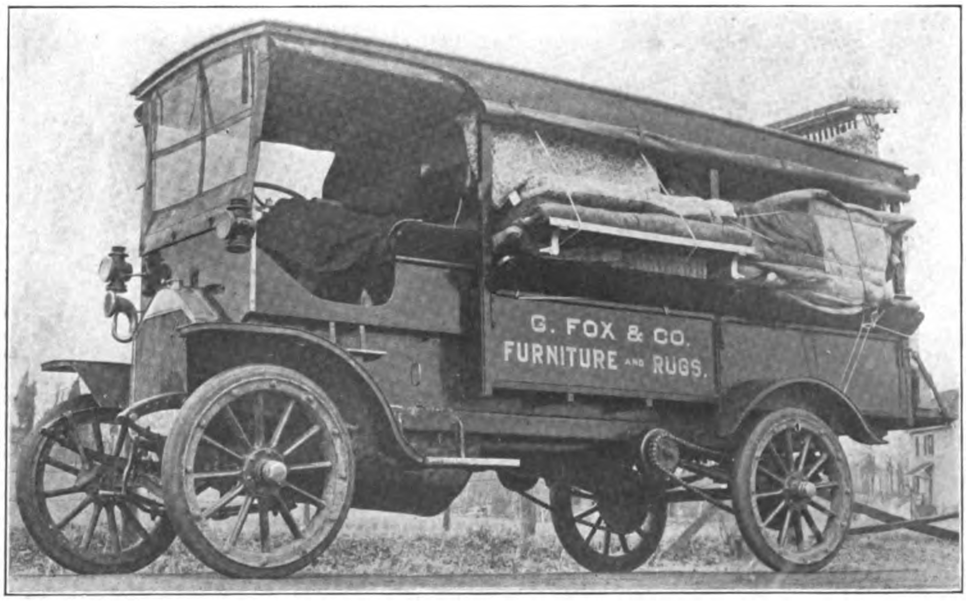
A field day will be enjoyed by the members of the Motor Truck Club of New York, Aug. 19, at the Marine & Field Club's grounds at Gravesend Bay, L. I., at which features will be field sports and a baseball game, and there will be a dinner, but without formalities. During the day the prizes offered in the membership contest now progressing will be awarded.

One of the features of the Labor Day observance in Milwaukee, Wis., will be the motor truck parade projected by the Milwaukee Automobile Club. A committee headed by Oscar Stegeman of the Stegeman Motor Car Company is working to make the event of large proportions.

DEPARTMENT STORE CONTRACT DELIVERY.

THE delivery by department stores is not always done with the equipment they own, and while it may be cheaper to own vehicles that can be constantly utilized, it is also a fact that the demands are so varying that great elasticity is necessary to meet them at all times. Most department stores endeavor to promote business when normally there would be a diminished volume, and as these sales attract purchasers from considerable distances, and sales are often of material proportions, delivery must be made. Under such circumstances recourse is generally made to those who make a specialty of haulage, and the prices are generally made on the basis of the work.

A Hartford, Conn., concern, G. Fox & Co., that has a department store of goodly size, does not own wagons or vehicles of any kind, but makes contract with different concerns to make its deliveries, these contracts providing for the regular and special work on the basis of a stated price for a day for a vehicle of a given size. In some instances owners of motor wagons contract to give precedence to the store's delivery, but are at liberty to undertake whatever work is practical and keep the contract.



The One-Ton Modern Wagon Making Contract Delivery for the G. Fox & Co.'s Department Store, Hartford, Conn.

Each owner of a vehicle having contract with the store is notified when he is wanted and arrangements are made so that he can be reached at different times during the day. An example of this service is found in a one-ton Modern wagon that is equipped with a body adapted for carrying furniture, and has a high top with side curtains. On the body is painted the name of the firm. This machine has been in use about eight months.

The wagon is used principally for furniture, rugs, carpets, etc., and it is utilized entirely for suburban delivery. The accompanying illustration was made while the machine was en route for New Britain, 11 miles distant from Hartford, and it carried the $200 load to its destination in 55 minutes. This load consisted of the full furnishings for a dining room, tables, buffet, chairs; the full furnishings for a bedroom, including a bedstead, spring mattress, mattress, chiffonier, folding couch, an extra table and a music cabinet. The following day the machine was sent out to Granby and climbed Talcott mountain with a heavy load. All of the towns in the vicinity of Hartford are covered, at least within a radius of 30 miles.

The owner of the truck says that the operating cost is about $7 a day, and that this will include all charges and with a good allowance for depreciation, maintenance and repairs. The driver has had a good deal of experience with other machines, and he is methodical in his driving and his care of the wagon. He insists that the body be clean and bright, and he is uneasy if the engine is not free from oil and dirt. Each morning he washes the chains with gasoline and greases them. He never races the engine and he is careful in engaging the clutch. He takes full care of the machine, making the adjustments minor repairs. He says that his work each day keeps the wagon in good running condition and saves no end of work at the end of each week. His care gives the owner a profitable investment and the department store has always at its service a thoroughly creditable vehicle.

From the viewpoint of the department store the contract method insures service that is practical and dependable and it has a sufficient elasticity to provide for any exigency that may arise, while there is elimination of the supervision and maintenance of equipment. G. Fox & Co. has given the contract service a consistent trial and has found that it is satisfactory. It is maintained that when a man drives and cares for his own machine he will take good care of it and will neither neglect nor abuse it, and that the responsibility that is lacking with the average hired driver is always established with the man who owns his vehicle.

The International Oil Industries Exhibition has been organized at London, Eng., for the purpose of holding an exposition of oils, greases and lubricants of all kinds at Earl's Court, London, March 24-April 4, 1914. In addition there will be a display of all kinds of lubricating devices, refining equipment, transportation facilities, fuel systems, motors, lighting and heating apparatus, and accessories. The show has been well promoted and it has the co-operation of different nations in which there are actively productive oil wells and refineries.

Municipal Service Equipment

DISCUSSES OPERATING EXPENSES.

Chief Engineer of National Board of Fire Underwriters Presents Interesting Comparative Figures.

Although he disclaims any attempt at a detailed consideration of motor fire apparatus in his report, nevertheless, George W. Booth, chief engineer of the committee of fire prevention of the National Board of Fire Underwriters, in his paper read at the recent annual convention of the National Fire Prevention Association, gave a more thorough, informing and authoritative resume of the entire subject than has hitherto been set forth in short space. He described at some length the types, uses and advantages of the various kinds of apparatus. He divided his subject into three classes, pumping engines, hose wagons and ladder trucks, also explaining numerous sub-divisions. Coming to the subject of service, he said:

The question of reliability under varying conditions has been much discussed by fire department officials. It is the general opinion that automobile apparatus, if properly cared for, is at least as free from break downs and delays as horse drawn. On bad roads there may be conditions of deep mud or sand or deep soft snow, where horses will struggle through and the automobile will fail because the wheels are not able to secure traction; but on the other hand, if there is any firm bottom which the driving wheels and chains can grip, the automobile will plough through stretches of bad going where horses would certainly become stalled.

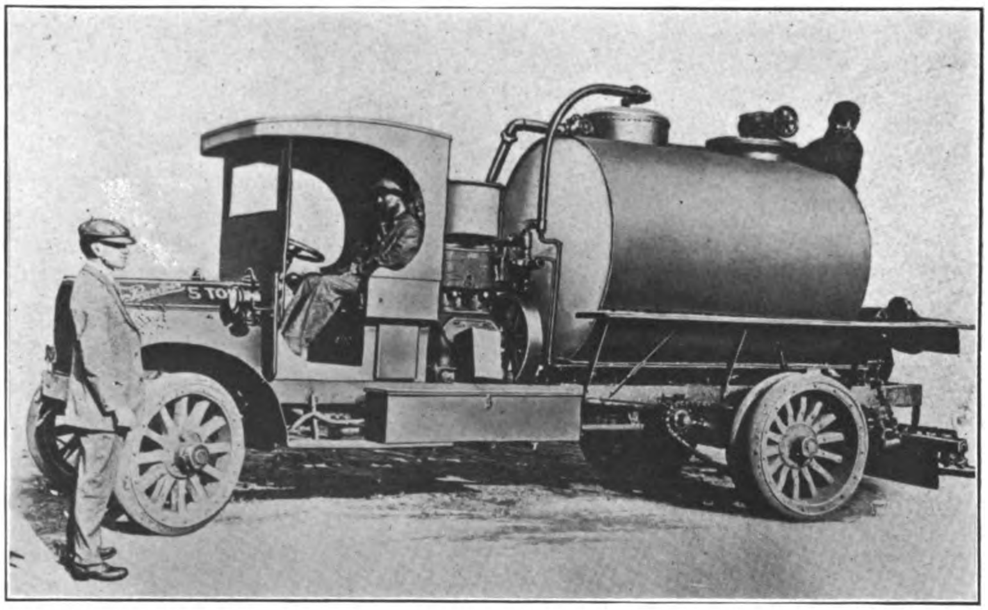
The reliability of the gasoline engine for driving pumps, as compared with the steam fire engine, has been questioned, although many chiefs who have used automobile pumping engines under trying conditions are ready to testify as to the effective results. As in any similar case where new problems are presented, considerable time and experimenting are required to develop a satisfactory machine; much progress has been made in the past year or two, although there is, of course, room for further improvement. The tests of pumping engines to be conducted at the convention of the International Association of Fire Engineers, in New York, in September next, which are to continue for a period of 12 hours, should go far towards establishing a fair comparison of performances.

The question of the relative economy of automobile and horse drawn apparatus is complicated by the uncertainty of such items as depreciation and repairs; automobile fire apparatus has not been in service long enough, at least in its present fairly well standardized form, to furnish reliable service records, nor are the records detailed and accurate enough in many cases to provide fair comparisons; consequently any estimates made now are subject to material revision. The following tabulations were compiled from study of records of over 20 cities, and what is considered a liberal allowance was made for the items of depreciation, repairs and operation, each one being three or four times as great per mile as the corresponding items for commercial trucks, as derived from carefully kept records for a number of years. The conditions governing the use of fire apparatus are such that the cost per mile of maintaining and operating it will be considerably greater than for commercial apparatus; the two main items of expense are for interest and depreciation, and any probable variation in the other items will not materially affect the result. As to depreciation, the commercial truck is expected to survive a mileage of 80,000 or 100,000 miles; of course, nothing like this mileage is to be expected from fire apparatus, since a yearly total of 500 miles is probably a high average, and a life of 25 years is assumed, not because the apparatus will be worn out at the end of this time, but because it is likely to be discarded for something better.

It will be noted that the yearly cost of apparatus for a horse drawn hose wagon is figured at $1800, as against $1420 for a tractor drawn steam engine and an automobile hose wagon, $1200 for an automobile pumping engine and an automobile hose wagon, and $780 for an automobile combination pumping engine and hose wagon. It is assumed that only two horses will be used on the steam engine; this is a common condition, but three horses are often used for large engines and where steep grades are encountered, and this will add about $260 to the yearly cost. It may be contended that 25 years is too long a life to expect for fire apparatus; however, the same life has been assumed for all classes of apparatus, so that the difference in cost of maintenance, whatever the life assumed, will be practically the same for all classes as noted here. The only item affected will be that of depreciation; if a life of 20 years is assumed instead of 25 years, $10 must be added to the depreciation item for each $1000 of the original cost. The cost of fuel for operating a pumping engine at a fire will be about $5 per hour for the steam engine, and $2.50 for the automobile.

For a ladder truck or water tower a tractor will show a slight saving over a two-horse hitch and about 40 per cent. saving over a three-horse hitch.

In this comparison no mention has been made of the number of men needed to operate apparatus. Although it is likely



Peerless Five-Ton Chassis Fitted with Specially Designed Tank for Transporting Heated Road Oiling Material.

that in many cases there will be no reduction in the number of men per company, the substitution of automobile apparatus for horse drawn will mean that one and often two more men will be available for active fire duty, and this is an important consideration in view of the tendency towards a weakening of the strength of companies through the granting of more time off.

COMPARATIVE FIRE APPARATUS FIGURES.

Hose Wagon—Horse Drawn.	Cost a Year
Cost, $2000.	
Interest at 4.5 per cent	$90
Depreciation, based on life of 25 years	45
Repairs and tires	30
Total	$165

Steam Fire Engines.	Cost a Year
Cost, $5500.	
Interest at 4.5 per cent	$247
Depreciation, based on life of 25 years	124
One new boiler and general overhauling costing $2000	84
Tires and repairs	70
Total yearly cost for engine	$525
Interest, depreciation and coal for heater	90
Total	$615

Two Horses.	Cost a Year
Cost, $600.	
Interest at 4.5 per cent	$27
Depreciation, based on life of 7 years	60
Shoeing	90
Veterinary	25
Harness	6
Forage	300
Total	$508

Two-Wheel Tractor.	Cost a Year
Cost, $4000.	
Interest at 4.5 per cent	$180
Depreciation, based on life of 25 years	90
Repairs, 9 cents a mile	45
Tires	40
Operation, 7 cents a mile	35
Total	$390

Automobile Hose Wagon.	Cost a Year
Cost, $5000.	
Interest at 4.5 per cent	$225
Depreciation, based on life of 25 years	112
Repairs, 9 cents a mile	45
Tires	60
Operating, 7 cents a mile	35
Total	$477

Automobile Combination Pumping Engine and Hose Wagon.	Cost a Year
Cost, $9000.	
Interest at 4.5 per cent	$405
Depreciation, based on life of 25 years	202
Tires	80
Repairs, 10 cents a mile	50
Operation, 8 cents a mile	40
Total	$777

Steam Fire Engine with Tractor.	Cost a Year
Cost, $9000.	
Interest at 4.5 per cent	$405
Depreciation, based on life of 25 years	202
New boiler, etc	84
Heater cost	90
Repairs and tires	125
Operation of tractor	35
Total	$941

Summary.	
Steam fire engine, horse drawn	$1125
Hose wagon, horse drawn	675
Total	$1800
Steam fire engine and tractor	$940
Automobile hose wagon	480
Total	$1420
Automobile combination pumping engine and hose wagon	$780
Automobile hose wagon	480
Total	$1260
Balance in favor of steam engine and tractor, over engine and horses, for year	$380
Balance in favor of combination pumping engine and hose wagon and automobile hose wagon, over horse vehicles, for year	$540

Cost of operating at fires would be as follows for a five-hour run, with two good streams:

Steam fire engine, 4 tons coal, at $5	$20
Gasoline engine, 60 gallons gasoline, at 17 cents	10

The main features of design of the various makes of apparatus have become fairly well established; there will undoubtedly come, after the period of experimentation is over, a standardization and simplification of details, which will reduce the cost of manufacture and facilitate repairs, and will be accompanied by a constantly increasing reliability.

PEERLESS IN ROAD OILING WORK.

Problem of Hauling Heated Material Long Distances Is Solved Effectually.

The problem of applying oil to the road surface at a distance of 20 miles or more from the starting point and to spread the material at a heat of 200 degrees or over, is one which has been solved effectually by the road commissioners of Los Angeles county, California, by the use of a Peerless five-ton truck, made by the Peerless Motor Car Company, Cleveland, O. As will be noted by the accompanying illustration the body has been especially designed for the purpose.

The chassis is fitted with a 1000-gallon oil tank, and the latter is covered with a coating of asbestos two inches thick. Oil is run into the tank at a temperature of 350 degrees, Fahrenheit, and thanks to the heat retaining quality of the asbestos protection and the speed at which the truck may be driven, it is possible to cover as many as 35 to 40 miles before the oil is too cold for use.

Air pressure of 60 pounds to the square inch is maintained inside the tank by an air compressor operated by the same mechanism as that used to actuate the dumping body for sand and gravel utilized with Peerless trucks. Heat from the motor exhaust is utilized to keep the oil spreader warm so that the material will not thicken and clog up at that point.

This machine covers an average of 50 miles a day, and the driver states that in 2000 miles of service only two involuntary stops were necessary on the road, both of these being caused by dirty gasoline stopping up the fuel line.

MOTOR PUMPING ENGINES.

Conditions Which Will Govern Tests During Fire Chief's Convention in New York City.

At the recent conference at New York City of the officers of the International Association of Fire Engineers, the New York sub-committee on tests and the leading manufacturers of fire appliances, the final regulations to govern the testing of apparatus were formulated. The statement of conditions governing automobile fire engines follows in part:

Exhibitors will be required to state in advance the rating they place on their pumping engines: That is, gallons discharged at 120 pounds net pressure, and at 250 pounds net pressure, or higher if the exhibitor elects; and exhibitors will be required to arrange for a preliminary test on Monday or Tuesday of convention week, or preferably during the preceding week, to verify these ratings. The preliminary test is expected to be sufficiently exhaustive to determine how much

water each engine can deliver at the various pressures before stated, but it is to be definitely understood that this delivery shall be no more than can be maintained for the full period of the final test.

An engine able to deliver, for example, 740 gallons at 120 pounds pressure, will be given a corresponding layout of hose and nozzles, unless the exhibitor desires a layout which will enable his engine to deliver its discharge at a higher net pressure. Ratings of engines will be considered as the next lower even 50 gallons than the quantity delivered at the preliminary test; for example, an engine delivering 740 gallons at 120 pounds net pressure will be rated at 700 gallons and one delivering 880 will be rated at 850 gallons.

The committee reserves the right, after the completion of the trials, to place any engine in another class than the one in which it is entered. The test will continue for a duration of 12 hours, but provision will be made for any exhibitor who so elects to continue for an additional period, delivering rated capacity at 120 pounds net pressure. The first 12-hour run will be as follows: Six hours delivering at 120 pounds net pressure the quantity determined by the preliminary test; three hours delivering at 200 pounds net pressure the quantity determined by the preliminary test; three hours delivering at 250 pounds the quantity determined by the first test. During any of the runs not more than two men at one time will be allowed to operate or care for the engine, and men may be relieved every four or six hours.

The dock on which engines will be tested is about eight feet above mean tide and the range in water level will not be more than about two feet above or below the mean. Gasoline of the same grade will be supplied for the use of all engines. Exhibitors may use any grade of lubricating oil desired. Records will be kept of the amount of each that is used.

Road tests of apparatus hauled by tractor, or for hook and ladder trucks with motors attached, will be over a one-mile course with an eight per cent. grade.

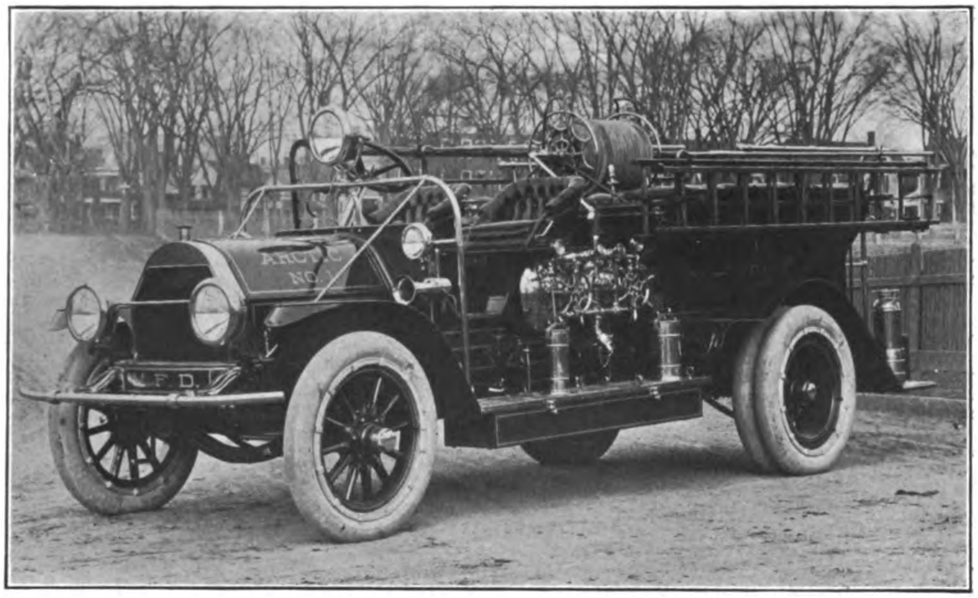
LATEST KNOX EQUIPMENT.

Double-Tank Chemical Car Now Utilizes Electric Lighting and Starting System.

An accompanying illustration shows the latest double-tank chemical wagon made by the Knox Automobile Company, Springfield, Mass., the principle feature of which is the use of electric lighting and starting, this being the first piece of fire apparatus made by this concern to be fitted in this manner. The outfit consists of the regular touring car design, made by the Esterline Company, Indianapolis, Ind. The lighting dynamo is mounted over the magneto on extension supports and is driven through silent chain. The starter has a direct drive on the flywheel through a small spur gear, and is put into operation by depressing a pedal midway of the floorboard. A storage battery of 120 ampere-hour capacity is furnished as an auxiliary.

The lighting equipment consists of Gray & Davis lamps throughout, two headlights, as well as two side and tail lamps, and a searchlight mounted on the centre of the dash. The car has a special handrail on the dash, strongly braced to enable the firemen to jump on the car while it is in motion. Another new fitting is a powerful bumper of a type similar to that which has been used with success on the Knox life saving cars in Springfield.

The Knox company also is meeting with decided



Knox Double-Tank Chemical Wagon, First Machine of This Type to Utilize Electric Lighting and Starting.

success in placing its Knox-Martin tractor with fire departments. The City of Springfield, which was the first to give this type of vehicle a trial on a water tower, has just purchased a second machine for use on a hook and ladder truck.

In the Market—Some of the cities in the market for motor apparatus are: Pendleton, Ore.; North Tarrytown, N. Y.; Milwaukee, Wis.; St. Paul, Minn.; Grand Rapids, Mich.; Concordia, Kan.; Edgewood, R. I.; Massillon, O.; Somerville, Mass.; Boston, Mass.; Lestershire, N. Y.; Brockton, Mass.; Joliet, Ill.; Rawlins, Wyo.; Pomona, Cal.; Albion, Mich.; Springfield, O.; Leavenworth, Kan.; West Springfield, Mass.; Des Moines, Ia.; Racine, Wis.; Butte, Mont.; Dallas, Tex.; Martins Ferry, O.; Jersey City, N. J.; Newark, N. J.; Middletown, O.; Northampton, Mass.; Laporte, Ind.; Fall River, Mass.; Fresno, Cal.; Lorain, O.; Tampa, Fla.; Kansas City, Mo.

New Commercial Car Accessories

Coes Screw Wrench.

The Coes screw wrench, produced by the Coes Wrench Company, Worcester, Mass., is a valuable addition to the repair shop equipment as well as to the tool box of the machine. It is constructed to withstand severe service and being all metal is not subject to broken handles, etc. The bar is of steel, fully hardened and cold swaged, while the jaw is made extra heavy, of semi-steel and hardened. The screw is steel, a one-piece construction, not a screw plus a moving dowel and a hidden spring, and is provided with a hardened and polished ball race. The handle is a semi-steel casting, internally supported and retained by cross riveting, and the extension of the bar through the handle is also riveted. The same grade of material and workmanship that has established this firm is notable in this product.

Pickup Pliers.

The Bremer-Wilson Manufacturing Company, 1421 Michigan avenue, Chicago, is marketing the Pickup pliers, which is an inexpensive tool as well as a handy instrument. It is an extension member, seven inches long when folded, but measuring 21 when extended. It is provided with a pair of jaws having milled teeth, enabling them to grip pieces of metal, such as nuts, bolts, etc., which may drop into the pan, transmission, crankcase or other place not easily accessible with the fingers. The tool may also be utilized for cleaning purposes by placing a piece of waste in the jaws and dipping it into gasoline. The pliers are constructed of high grade material, nickel plated and should prove decidedly practical.

Campbell Tell Tale.

The law requires that the tail light shall be lighted during certain periods and when the car is being operated as well as standing still. In some cities the ordinances are strictly enforced and no excuse is accepted if the driver is caught with the rear lamp unilluminated. The Campbell Manufacturing Company, 3715 Wentworth avenue, Chicago, has brought out a practical device for notifying the driver when the tail light is extinguished, and the device is made in three styles, namely: For kerosene or gas lamps, electric and combination. When utilized with kerosene or gas lamps the tell tale, as it is called, is inserted in the lamp is such manner that it is in proximity to the flame. The heat of the blaze expands the metal, thereby breaking contact between two points. If the light goes out, the metal becomes cold and contracts, contact being made between the two points mentioned, and an electrical circuit is made. Current is supplied by a single dry cell and when the connection is made by the points referred to, a buzzer is sounded, calling the attention of the driver to the lamp. The metal of the tell tale is very susceptible to heat or cold, insuring a warning in a few seconds if the flame of the lamp is extinguished. The wiring plan of the electrical unit is also illustrated and its simplicity is apparent. With either design the electric horn may be utilized in place of the buzzer if desired. The Campbell tell tale is moderately priced.

Durno Motor Starter.

The Durno Manufacturing Company, Rochester, N. Y., is marketing the Durno motor starter of the compressed air type. It differs from conventional design in that the pressure is utilized to actuate a mechanical device instead of being led to the cylinder of the motor. The mechanical member comprises a drum fitted to the front of the machine and carrying an auxiliary shaft engaging with that of the engine. The drum carries a chain attached to a rod and connected to a piston rod of a cylinder having a four-inch bore and 12.5-inch stroke. Air is admitted to the cylinder from a pressure tank which is supplied by a four-cylinder air pump operated by the motor. Pressing a lever on the footboard of the car allows air to flow to the cylinder member, forcing the piston backward and unwinding the chain on the drum. At the same time the auxiliary shaft is thrown into engagement with the motor shaft, spinning the latter, and it is held that energy is imparted slowly at first. The system is provided with a night valve for the purpose of preventing escape of air when the car is not in service. A tire inflator is part of the equipment, and includes suitable length of tubing and a gauge.

Agner Simplex Socket Wrench.

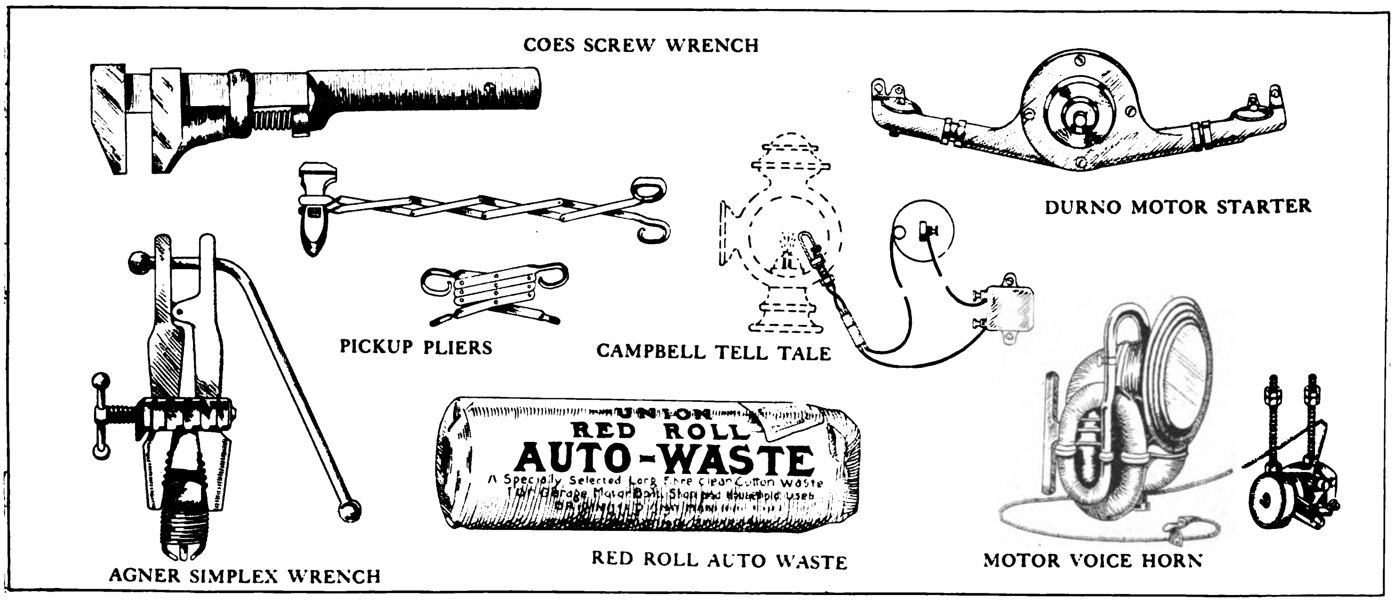
The Agner Simplex adjustable socket wrench, manufactured by the R. C. Agner Company, Burlington, Wis., presents interesting features in that it may be employed for a number of useful purposes. It is especially adapted for removing and replacing spark plugs from valve caps not easily accessible with ordinary tools, having as it does a pair of movable jaws which are locked by a small clamp. It may also be utilized on square or hexagonal nuts or bolts, or as a tap wrench. Another feature of the device is that it may be employed as a tap wrench. It is constructed of high grade material, nicely finished, and is very compact.

Motor Voice Horn.

The Motor Car Equipment Company, 55 Warren street, New York City, is marketing the Motor Voice horn, which differs from conventional signals in that energy is supplied by compressed air furnished by a small air motor. The latter is mounted on the frame of the chassis in such manner that a friction flywheel is brought into contact with the flywheel of the engine when desired. Connection between the air motor and the horn proper is by a flexible metallic tube. The air motor is actuated by a Bowden cable to which is secured a special clip mounted on the steering wheel. The horn is as easily operated as an electric and it is claimed that the tone is similar to a siren horn, as far reaching, but of a pleasing character. One of the advantages of the horn, and one that will be appreciated by the truck driver, is that it cannot be operated by the small boy when the car is standing still.

Union Red Roll Auto Waste.

The Union Wadding Company, Pawtucket, R. I., has originated a novel method of compressing into a single sturdy container, 12 separate handfuls of waste, each of which may be taken from the package without disturbing the others. The material is compressed into a compact roll sufficient for all ordinary requirements. The advantage of this packing is obvious. It keeps the waste clean, prevents tangling up in the tools, etc., when carried in the tool box; can be stored in a small space and is always handy for service. The package is but 12 by three inches, and the container is of sturdy construction. The waste is a specially selected long fibre.



Illustrating Some of the Latest Accessories Adaptable to the Commercial Vehicle, Garage and Repair Shop.

FOREIGN TRUCK NOTES OF INTEREST

LONDON MOTOR 'BUS SERVICE.

Some Factors in Their Operation Which Will Prove of Interest to American Cities.

The experience of London, England, the largest city in the world, with motor driven vehicles in public service, is of decided interest to people living in the large cities of the United States, where the traffic conditions are such that there is a constant problem of congestion. Self-propelled public service 'buses have not been adopted in America except on a small scale in isolated instances, but the matter is now attracting much attention in such cities as New York, Chicago, Philadelphia, Detroit, etc.

Since 1909 it has been amply demonstrated in London that the lower running cost a mile of the motor vehicle, its superior mobility and the greater frequency of service which is possible with the larger number of smaller units, are factors which have enabled the 34-seated motor 'bus seriously to compete with the 78-seated electric street car. The extent to which motor 'buses have developed in London may best be appreciated by the following table:

	Street Miles	No. Motor 'Buses
Dec. 31, 1909	114.8	1049
Dec. 31, 1910	121.4	1097
Dec. 31, 1911	174.1	1634
Nov. 30, 1912	336.6	2527

The fact that the noted increases in totals of motor 'buses have not led to undue congestion in London calls for special comment. The figures disclose an approximate average of 10 vehicles in service a mile of route worked, with a downward tendency in 1912, the average at the end of that year being barely eight a mile, indicating better and more careful distribution. Comparable data for the London County Council electric street cars show an average of 11.5 of the bigger vehicles a street-mile served.

The average speed of an electric car is at least two miles an hour less than that of a motor 'bus, which is able to travel an average of at least 20 miles more than street cars in a working day. Therefore, taking the smaller average number of motor 'buses a mile of street served, travelling at higher average speeds than the street cars, it is obvious that the congestion due to latter is greater. The ability of the independent vehicles to draw around obstacles, or to deviate temporarily from a disturbed route, and the absence of delays to the whole system when a failure of individual mechanism occurs, are contributory factors, the importance of which is becoming more and more realized by the proprietors, recognized by the police authorities and appreciated by the travelling public.

So profitable had the working of the motor 'buses become in 1912 and so serious a competitor had the road vehicles proved themselves to be with other forms of passenger conveyance, that Sir Edgar Speyer decided to acquire the property of the London General Omnibus Company, Ltd., the leading English motor 'bus concern, for the benefit of his electric railway undertakings. The $500 shares of the company, which stood at only $90 in December, 1909, had risen steadily to $2000 in June, 1912, and the residue of the minority, who opposed the sale, were, with the approval of the courts, bought out at $1375 for each $500 of stock a few months later.

AGRIMOTORS AND TRACTORS.

Some Foreign Tendencies as Revealed in Recent Exhibitions and Manoeuvres.

Details concerning the commercial vehicle display at Olympia, London, England, have not yet been received in this country, but it is anticipated that interest in the event will be considerably augmented by the very successful exhibition of motor equipment suitable for farm use at the Royal Agricultural Society's show in Bristol a few weeks earlier. A large section was devoted to what the British term agrimotors, or tractors designed to operate plows, hoes and other farming implements.

The Bristol display was much on the order of an old fashioned cattle show in this country. Cattle, horses and produce were exhibited in booths arranged for that purpose, and the motor vehicle section virtually was a part of the whole, being housed in sheds, etc., each more or less detached from the others. The plan offered opportunity for demonstrating the various products, thereby calling the fullest attention to their merits.

A particular feature of this year's display was the exhibition of a larger number of tractors and trailers for road haulage. This branch of the industry has received rather more attention abroad than in this country, as is evidenced by the part trailers have played in the annual military manoeuvres in Continental Europe. An accompanying illustration presents one of the Latil front-drive combinations in this year's French trials and indicates the importance which is attached to the matter of short turning radius.

Among the British products revealed recently is the six-ton Lacre chassis fitted with a new hoisting device. The motor is a four-cylinder unit rated at 40 horsepower. Drive is taken through a leather faced cone clutch of ample size by shaft to a gearbox affording four forward speeds and reverse. The gear-

box and universal form a unit, and final drive is by side chains. Fitted on the main drive between the clutch and transmission is what is termed a spring shock absorber, the object being to permit of some little elasticity between the gears and clutch when the latter is engaged.

Driven by dogs from the tail end of the gearbox, the drum shaft, which has a diameter of three inches, is carried through to the extreme rear of the chassis and runs in bearings of ample size. At the gearbox end the fingers of the clutch are double the usual length. When it is desired to transmit the drive to the road wheels, this clutch is entirely disengaged. When in position for operating the hoist, however, the dog clutch is partially engaged. When engaged to the limit the spur pinion for the hoist drive is brought forward by the sliding of the shaft, clear of the pinion, and a second dog clutch at the extreme rear end of the hoist drive is thus brought into engagement. This drives a 4.5 by 14-inch pulley direct, and provision is made for a pulley up to three feet six inches diameter.

The third position is for belt drive to threshing engines, machine tools, dynamo, etc. The shaft to the hoisting gear is controlled by a lever located at the side of the chassis frame, and a spring adjustment is provided, which enables the gear to be worked by one man. In case the dog clutches cannot be engaged owing to the position of the main clutch, the engine can be started up, and on the turn, when the dog clutches are in a position for engagement, the spring drives the gears home.

TRUCKS ON THE RUSSIAN STEPPES.

Mining Company Orders Two Commers to Replace Camel Transport Over the Barren Sands.

A feature of the development to which the commercial vehicle industry has attained is the manner in which exceptional methods of transport are being superseded by various makes of motor trucks. It is now announced that the Spassky Copper Mine, Ltd., a Russian mining company, has ordered a two-ton and a four-ton Commer for use on the steppes in place of its camel transport for the conveyance of material and supplies from the railroad terminal at Djoosale to the mines, located 250 miles distant across the bare and uncultivated steppes.

On the machines designed for the heavy work, steel tires were fitted to the wheels. As many miles of loose, shifting sand, in addition to rivers of varying depth, have to be crossed en route, the magneto, engine, coil and all parts of the transmission are adequately protected from water and sand, both as to type and position. Two drivers go with the machine on each trip, suitably provisioned for two weeks, which is the time occupied on the journey. Various appliances are fitted to the machines to extricate them from any difficulties encountered. On the rear of the truck is a winding cable, intended for service when the machine has sunk in a river bed or shifting sand. Suitable stakes and anchoring tackle are carried and the wagon hauls itself free by its own power. Roads are non-existant in that part of the world and the journey is one of the hardest tests to which a motor vehicle can be put.

Latil Front-Drive Tractor and Trailers in Recent French Manoeuvres, Indicating Short Turning Radius Provided.

ALL HORSES DISCARDED.

British Manufacturer of Cocoa and Chocolate Depends Entirely upon Motor Equipment.

One of the first British concerns to eliminate horses entirely from its delivery service is that of Cadbury Bros., Ltd., Bournville, near Birmingham, maker of cocoa and chocolate. At present it has seven vehicles, one one-ton and five 3000-pound Thornycrofts, and one 1000-pound Ford. All are worked constantly during the winter months, but during the summer it is found possible to release each machine in turn for overhaul, painting, etc.

Some of these cars cover an average of 500 miles

a week. The small are used generally in the delivery of express orders to caterers, places of entertainment and social functions, while the large deliver more important orders to customers at a distance. While no figures have been made public relative to the economy effected, the owner is convinced that deliveries are now made more cheaply than with horses. Concerning the advantages, a member of the firm is quoted as follows:

"They certainly do exist. A decided one is the speed with which delivery can now be made. It is very pleasing to a customer situated, say, 20 miles away, to receive delivery of his goods the same day on which his order reaches the works. Promptness of this kind would be impossible but for the motors, and this feature has, we are sure, brought us extended custom among local people. When comparing motor transport with railways, goods dispatched by rail need to be packed carefully in boxes, whereas, when delivery is by motor, this is unnecessary. This method of transportation offers decided advantages in the direction of promptness, advertising effect, cleanliness and general utility."

GENERAL NOTES FROM ABROAD.

Ford Wagon in Scotland—As a result of competitive bids recently opened by the Stirling County Council, Stirling, Scotland, the local agent for Ford cars, made by the Ford Motor Company, Detroit, has closed a sale for a two-seated runabout.

Opportunities in India—Many people in India are purchasing low priced automobiles for use in place of horse drawn vehicles for business purposes. American made cars are in large demand because of their price and thoroughly dependability.

Motor Trucks in Siam—Recent reports from Siam indicate the receipt of a large number of motor trucks during the past few months. The Siamese government has installed several vehicles of this type for the use of the army, and many of the merchants in Bangkok have decided to employ motor driven delivery wagons.

Electrics in Austrian Postal Service—The Austrian postal authorities have recently placed in service 30 electric motor mail vans for use in Vienna and suburbs. The vehicles are used mainly for the transportation of mails to and from the railroad stations. A new post-office garage, capable of housing 50 electrics, has been erected in Vienna.

Americans Win in Roumania—As a result of the recent competitive tests held at Ciulnitza, Roumania, under direction of the Sindicat Agricole of the Jalomitza, a co-operative agricultural institution, gold medals were awarded to two American houses, the Emerson-Brantingham Implement Company and the Pioneer-Lascelles. Three silver medals also were given to American machines. The cup of honor was awarded to the Lanz firm of Mannheim, Germany. The names of the winning American machines were not forwarded to this country.

Bread Delivery in Victoria—The advantages of motor delivery are being demonstrated in an effective manner in Eaglehawk, Victoria, southern Australia. An enterprising baker in that city recently installed a light van, with which he has been able to extend his delivery into the surrounding districts and thus materially increase his business.

Opportunities in Buenos Aires—An engineer residing in Buenos Aires, Argentina, is authority for the statement that there is a growing market for light delivery vans in several portions of the country. Regarding heavy duty vehicles, he suggests that special attention be paid to the matter of strength in the construction of machines, and that they be shod with solid rubber or steel.

Argyll Fire Apparatus—Several of the county councils in Scotland have been installing motor fire apparatus made by Argylls, Ltd., Alexandria, and that these have been giving excellent service is borne out by the testimony of the firemaster at Dundee, who reports that recently one of these machines attached to the local brigade worked continuously at a fire for 12 hours without any difficulty.

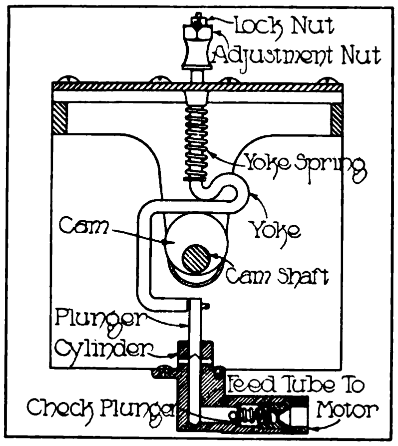
Paris Has Traffic Board—The Paris prefect of police has appointed a traffic board, which will meet on the first and third Thursdays of each month to consider all traffic problems. The president of the board will be an inspector-general of traffic, the other members being official representatives of the Cab Owners' Union, the Cab Drivers' Union, the Transport Workers' Union and the Transport Contractors' Union.

Conditions in South Africa—Recent reports from South Africa indicate that the average cost of running motor vehicles in that district is about 12 cents a mile. This is held to include use in towns and open country, although in the latter instance it is found that mere tracks exist in lieu of roads. The people are rapidly beginning to appreciate that the success of the mechanical transport depends very largely upon better highways, and a movement is under way to further good roads work in several localities.

Dennis Vehicles in Athens—The Greek government recently purchased two four-ton Dennis water tank wagons and a fire engine, made by Dennis Bros., Ltd., Guildford, England, which have been subjected to exacting tests at Castella, near Athens, under the direction of the city engineer of Athens. These are understood to be the first vehicles of these types to be used in the Greek capital, and if they prove a success, as now seems evident, it is expected that additional equipment will be purchased in the near future.

HINTS FOR PROPER MAINTENANCE.

THERE are times when the amount of oil fed to the motor should be increased or decreased. After an overhaul of the power plant and the bearings have been taken up, it is important that the lubricator be set to supply a larger amount of oil than normally. After the bearings have become worked in the amount may be cut down. Lubricators are adjusted easily if one understands the principle of operation. That shown in the accompanying illustration is of the mechanical type, a cam raising and lowering a plunger, which forces the oil past a check valve to the working parts. As the amount of lubricant forced depends upon the stroke of the plunger, this member is made adjustable.



Adjusting Mechanical Lubricator.

The variation of the stroke is accomplished by restricting or increasing the movement of the yoke member, and an adjusting nut secured by a lock nut is provided for this purpose. To decrease the amount of oil the adjusting nut is screwed down, diminishing the quantity of lubricant, while raising or lengthening the stroke increases the amount.

This type of oiler is very efficient and the only trouble likely to be experienced is through clogging of the feed pipes. This can be avoided, however, by using a clean oil, one free from foreign elements. A clogged pipe is indicated by the plunger remaining up or stationary. The obstructions can sometimes be removed by operating the plunger by hand. When the oiler is set temporarily to increase the amount of lubricant, in cutting down the quantity, care should be taken to make the adjustment so that the proper level will be maintained in the crankcase. This can be determined by a little experience.

REMETALLING BEARINGS.

The remetalling of bearings is a job which requires care if satisfactory results are to be obtained. In an accompanying illustration is presented a suggestion for a jig, which is said to prevent blow holes and to provide a smooth bearing surface. It comprises a stiff iron plate of suitable dimensions and drilled to receive the stud member. The clamp, which is shaped to leave a space for the pouring of the metal between the inner side of the bearing and the tube, is secured to the stud as shown.

Between the edges of the brasses are placed graphited tin strips secured by a clip. To prevent leakage of the molten metal from the bottom a piece of asbestos packing is utilized. This arrangement permits of metalling a pair of brasses at a time. If care be exercised in heating the brasses the old metal may be removed without injuring the tinned surfaces. It is important that there be a sufficient number of holes in the shell for securing the new lining in addition to the tinning.

LOCATING SMALL SCREWS.

Small screws, especially machine, are sometimes difficult to start, particularly when located in places not easily reached by the fingers. A small wire bent double at one end and slipped under the head of the screw will hold the latter steady while the threads are being caught. Another method is to cut a V slot in a small strip of tin. This plan is recommended because the device will take several sizes of screws. Still another suggestion is to take a piece of stiff paper and push the screw through it.

STRIPPING WIRES.

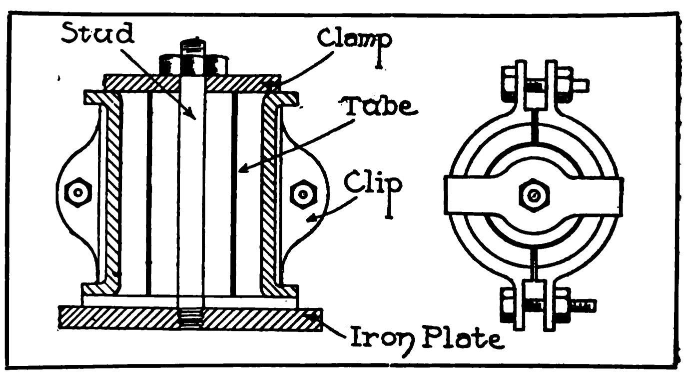
The usual practise in stripping insulation from ignition wires is to employ a knife. This results in more or less of the copper strands being cut, reducing their number. An excellent tool for this work is a clip, such as utilized for cutting the finger tails. One that has seen considerable service is best adapted for the purpose.

CARE OF OILY WASTE.

Oily waste and greasy cloths should not be allowed to accumulate in the garage unless stored in a suitable container, owing to the danger of spontaneous combustion.

HOME MADE PISTON CLAMP.

Replacing a piston in the cylinder requires care, as the rings are easily broken. While string may be utilized to compress the rings, a clamp made for this work is much superior and it also saves time and labor. A



Suggestion for a Jig for Metalling Brasses for Big End Bearings.

clamp may be made easily and at slight expense.

Assuming that the piston is 4.25 inches in diameter: Take a strip of band iron .125 inch thick, .5 inch wide and 16 long. Bend the metal into a circle and measure off 1.5 inches on each end, marking the distances. Place the ends in a vise and bend them over. This will provide extensions which may be gripped by the pliers when the clamp encircles the ring.

The band should be slightly less than 4.25 inches in diameter to compress the ring fully. To use the clamp, place it over the top ring and draw the ends of the band together with a pair of pliers while an assistant slips the cylinder over the head of the piston and ring. Upon the latter being caught the pliers may be released and the clamp used on the next ring and so on until the work is completed.

FEATURES OF KELLAWAY KEROSENE CARBURETOR.

A GASOLINE-KEROSENE carburetor of ingenious design, one permitting the use of either liquid or both together, is the Kellaway, a description of which appears in a recent issue of Motor Traction, an English print. Among the advantages noted in the Kellaway is that the butterfly throttle valve is eliminated, the throttle being placed on the atmospheric side of the vaporizer. Some authorities on heavy fuel carburetors hold that the desired finely sprayed fuel is not obtained with the butterfly throttle valve, particularly at low motor speeds; that it does not make for complete and effective pulverization of the fuel.

The Kellaway design, an elevation and sectional view of which are presented at Fig. 1, may be said to be of the rising air valve and fuel control needle type. When the air valve rises from its seat pure air can enter the motor, but when seated all air must pass through special ports up and down concentric tubes and past the fuel jet, which, being of special design, admits either unmixed or mixed fuels, according to the position of the taper needle valve. Details of the fuel valve, which is controlled from the seat, are presented in the illustrations and a little study should enable the reader to understand its action.

The main body of the vaporizer A has a domed cover, retained by wing nuts, making for accessibility. On the left is an extension of the body whereby the carburetor is connected by a suitable union to the intake pipe or manifold of the motor. Fitted into a recess in the body casting is B, a cylinder bored in two diameters, and sliding in this is a piston C, to which is secured by a lock nut the air control valve D. The method whereby a dash pot action is secured is illustrated in the drawings. From the upper end of the piston, conveniently secured by a spring and bayonet joint, as indicated, depends a rod E, at the lower end of which, attached by a tee joint, is F, the fuel control needle, which is parallel, and a sliding fit in the nozzle piece G. The last named has a recess H bored in it. J is the fuel inlet for gasoline and K for kerosene. It will be seen that the recess H communicates with the fuel inlet J, and that K conducts to a well L, into which dips the end of the fuel control needle, having at M a taper slot.

The general effect of this arrangement is that, while gasoline can pass from the inlet J through the ports indicated into the recess H, and upward around the helical channel indicated as cut around the fuel control needle F, and emerge at the jet nozzle N, the kerosene cannot make its way to the recess H until the air valve rises, taking with it the needle, and so allowing the heavy fuel to pass by the way of the taper slot M. A plug, as shown, closes the well.

Around the cylinder B are small drilled holes O, and above the lock nut that secures the air valve are, in the piston, larger taper holes P. Encircling the body casting is a sleeve type throttle valve Q, having specially shaped air holes R in it, and registering with similar holes in the body casting. Concentric tubes S and T surround the fuel control device, as shown in black in the drawings, the former fixed at its lowest end to the body casting, and the other, by its upper end, to the rising piston. It will be seen that air can pass through the holes R in the throttle valve, through

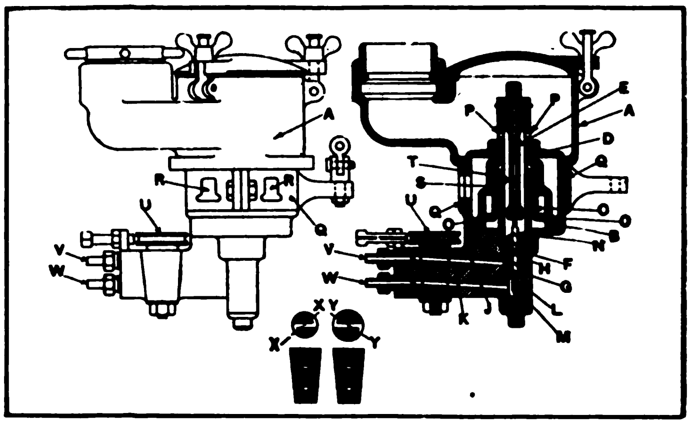


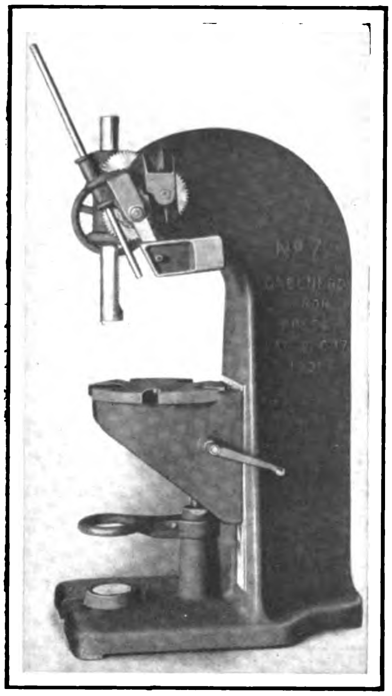
Fig. 1—Elevation and Sectional View of Kellaway Bi-Buel Carburetor in Which the Usual Butterfly Throttle Valve Is Replaced by a Sleeve Type and in the Atmospheric Body.

the holes O, up around the outside of the tube S, down between the two tubes and up past the jet nozzle, and finally out through holes P into the induction pipe. The space under the domed cover is practically the mixing chamber.

The conical valve V controls the liquid entering, as to gasoline by the connection V, and kerosene by the connection W. The valve is operated by a wire control passing around the grooved pulley and guides, the lead being conducted to a quadrant on the dash. Below the sectional drawing are shown two horizontal sections of the conical valve, with vertical sections respectively cutting on lines X X and Y Y. The holes, channels, etc., are so cut and arranged that by operating the valve either gasoline or kerosene or a mixture of the fuels may be utilized. The annular space between the lower end of the tube S and the jet nozzle forms a well that may be flooded with gasoline which is used for starting purposes.

GARAGE AND SERVICE STATION EQUIPMENT.

PORTABLE, mechanical tire pumps are a valuable addition to the garage and service station, as they may be utilized for cleaning purposes as well as for inflating tires. The Taylor Manufacturing Company, West 14th street and 48th avenue, Chicago, is marketing a compact electrical outfit which is shown in an accompanying illustration. The pump proper is driven by a .25 horsepower motor which is constructed either for direct or alternating current and for varying voltages.



No. 7 Greenerd Arbor Press, Taking a Diameter of 36 Inches and Providing a Pressure of 25 Tons.

The outfit is mounted on an oak base and may be moved easily about the garage, it rolling on four heavy steel casters. A looped steel handle is provided, making for convenience. The motor is mounted beside the pump and drive from the former is by means of steel pinions and cast iron gears. The equipment is very complete, including 15 feet of high grade flexible hose with connections and pressure gauge and 15 feet of electric wiring and socket.

The pump itself is known as the Noil, so named because its operation precludes all possibility of lubricant or oily vapors being carried into the inner tube with the air when inflating. The pump works on the plunger-diaphragm principle, and it is held that frictional heat is eliminated. It is 7.5 inches high, weighs 6.5 pounds and employs no leather cups, etc.

The crankcase is of aluminum, and gears and plunger of solid bronze. The plunger is specially constructed and it is held that it will withstand a pressure of 1000 pounds. Among the qualities claimed for the Noil are that it will deliver a steady flow of air and that it will supply from 90 to 150 pounds at low speeds.

NO. 7 GREENERD ARBOR PRESS.

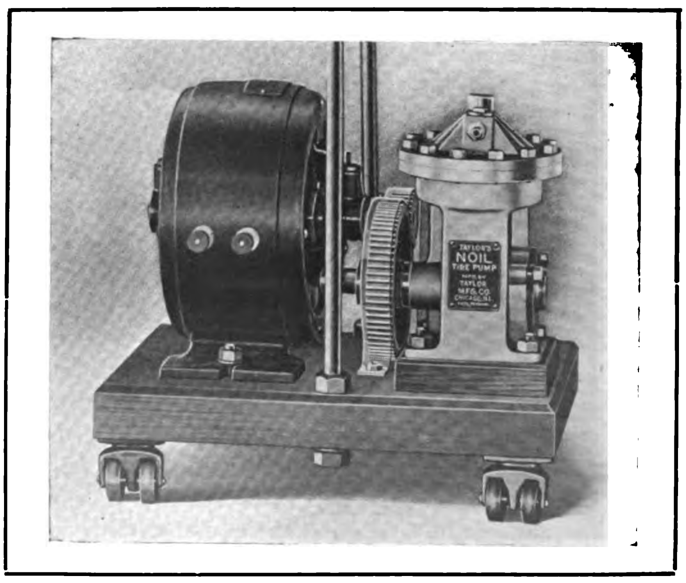
Arbor presses are utilized for a number of purposes in the repair shop and service station and included in the work these machines accomplish is the straightening of rear axles, etc. Edwin E. Bartlett, 330 A street, Boston, manufactures a wide variety of Greenerd arbor presses and in an accompanying illustration is shown the No. 7, one of the largest of this type produced by the concern. It takes a diameter of 36 inches and has a leverage of 250:1, and a pressure of 25 tons is obtained easily. No change in principle or design has been made from the well known No. 5 Greenerd machine except in size and capacity. When the lever is in the position indicated in the illustration, the rack or ram may easily be moved up or down by means of the hand wheel.

The knee is operated by the crank shown, revolving a screw through a pair of mitre gears. This screw runs in a nut in the base. The design is such that the knee can be lowered to its extreme position without the screw reaching the floor, making it possible to place the press in any position without cutting the floor for the screw. The knee is held to the frame by two studs and nuts, the nuts being adjusted and locked so that the knee can be moved easily. The pitch of the elevating screw is such that these nuts do not require tightening to hold the knee under heavy pressure.

The No. 15 Greenerd is especially adaptable to automobile repair shops and has advantages over the No. 3.5, 4 and 5 sizes in that the capacity is 36 inches between the uprights and the opening under the revolving plate is 10 inches. One man can obtain seven tons, while two can secure 10 tons pressure. The maker is issuing a circular on arbor presses giving complete details, which will be mailed upon request.

FISHER QUICK ACTING VISE.

Fisher & Norris, Trenton, N. J., is manufacturing what is known as the Fisher quick acting lever vise. It is constructed of gun metal with a solid bar and all parts are interchangeable. The work is inserted in the jaws and held securely by a forward movement



Taylor Noil Portable Garage Tire Pump, a Compact Unit Operated by Electricity.

of the lever. The part cannot be removed until the lever is pushed back. The jaws are faced with steel, file-cut and properly tempered.

CORRESPONDENCE WITH THE READER.

Motor Efficiency.

(38)—Having purchased and converted a pleasure car into a light truck, we find that it does not develop the power it should. A motor expert states that the valves are too small and should be enlarged, as well as a number of other conditions. Is there any method, and one not involving too much expense, whereby the valves could be improved? INFORMATION.
Lockport, N. Y., July 10.

The efficiency of some types of old motors may be increased by alterations, such as reboring, enlarging the valves, etc., but it is not advisable to undertake too many changes owing to the expense involved.

It is not always possible to fit larger valves, but alterations may be made to improve their efficiency. Herewith are presented suggestions of this nature, the sketch at A showing how an improvement may be made to the inlet member. The same size valve is retained, but the port area has been increased by cutting away a portion of the seating, the metal removed being denoted by the shaded sections. This reduces the obstruction to the incoming gas very materially.

At B is presented a sketch showing how the outline of an inlet may be improved and brought nearer the stream line shape. In order to give the incoming gas a flow as easy as possible, a part of the underside of the inlet valve is removed. This portion of the valve requires the most treatment, leaving only a conical face for the proper seating. The exhaust valve could be treated similarly by cutting away the metal as shown at A and enlarging the port area.

Suggested Oil Gauge.

(39)—I am bothered by my model T Ford motor smoking excessively, although the instructions of the agent are followed carefully. Although the engine is equipped with an oil gauge of the type sold for this purpose, it is difficult to note the level of the oil unless you stoop under the fenders, and many times the glass is so covered with dirt that the oil cannot be seen. Is there any gauge made to show the height of the oil without these annoyances? A. W. D.
Indianapolis, Ind., July 5.

The A. C. Danver Company, Providence, R. I., is marketing a special oiler for the car mentioned which is said to eliminate undue smoking and which has a gauge so mounted and located that it is an easy matter to note the height of the lubricant in the crankcase.

Adjusting Schebler Carburetor.

(40)—Can you give me any information as to the cause of my not being able to set a Schebler carburetor so as to obtain a smooth running motor, when throttled down, and power at high speeds? If the carburetor is set so as to start easy and throttle, the mixture is too rich at a high speed. I have changed the position of the arm on the dial, also the air valve and the needles, but do not get results. A. K. S.
Worcester, Mass., July 21.

The failure to obtain the desired results or flexibility at all motor speeds would indicate the presence of auxiliary air, as the mixture is too rich when the throttle is opened. It should be remembered that the needle valve is lifted by a cam, increasing the supply of fuel. The writer recalls a similar instance where the trouble was found to be worn valve stems. The space was such that considerable air was admitted at low speed, compelling the use of more fuel than could be successfully vaporized at higher speeds. The effect of auxiliary air is more pronounced at slow motor speeds than at high when there is greater or steadier suction. Examine the valve stems, intake manifold and connection between the latter and the carburetor.

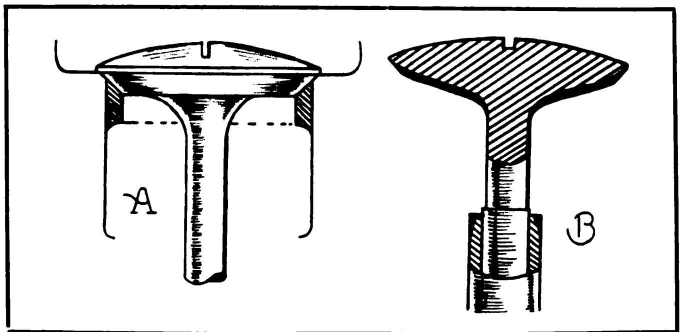
Bi-Fuel Carburetors.

(41)—What is the meaning of bi-fuel? I note reference made to it in a motoring print. Is it a combination of two fuels in a carburetor, and if so how is it brought about? DRIVER.
Toledo, O., July 3.

By bi-fuel is meant two fuels. In a number of carburetors designed to utilize heavy fuels, provision is made for the use of gasoline for starting, after which kerosene is utilized. Some types can use either gasoline or kerosene independently or together. Elsewhere in this issue will be found an article on heavy fuel carburetors which explains their action.

Gear Shifting Troubles.

(42)—We have a converted pleasure vehicle with a cone clutch which we utilize in our business and the driver complains he has trouble in changing from one speed to another. We have had to renew some gears in the transmission presumably because of the trouble, although the gears were worn when we purchased the machine. What causes the trouble and how may it be overcome? SUBSCRIBER.
Utica, N. Y., July 19.



Increasing Efficiency of Motor: A, Showing How Valve Port Area May Be Increased by Cutting Away a Portion of the Seating; B, Improving Outline of Inlet Valve, the Solid Black Portions Representing the Metal Eliminated.

It is evident that the inertia of the flywheel is not overcome; that is, the clutch shaft spins after releasing the clutch, making it difficult to mesh the gears. The trouble may be overcome by fitting a clutch stop or brake. This is secured to a cross member or transmission casing and when the male portion of the clutch is withdrawn it comes in contact with the stop, checking the rotation of the wheel. The method of constructing and fitting clutch stops was described in a recent issue of MOTOR TRUCK.

A. F. Mais has resigned as consulting engineer of the Studebaker Corporation and will take a rest before associating himself with another well known concern. Mr. Mais designed two Studebaker trucks, which were exhibited at New York last winter and which have been thoroughly tested and developed. These machines have not been produced commercially because of the need of all the factory facilities for producing passenger cars. They were of the internal gear driven type. Mr. Mais also designed the Mais truck, built by the Mais Motor Truck Company, Indianapolis, Ind.

THE A B C OF MOTOR TRUCK IGNITION.

Part XII---Explaining the Method of Collecting Current Obtained with the Magneto and Its Distribution to the Spark Plugs---Construction of Distributor Components and How the Spark Is Timed.

By C. P. Shattuck.

HAVING explained the generation of the primary current and its interruption by the mechanism of the circuit breaker, the transformation of the low

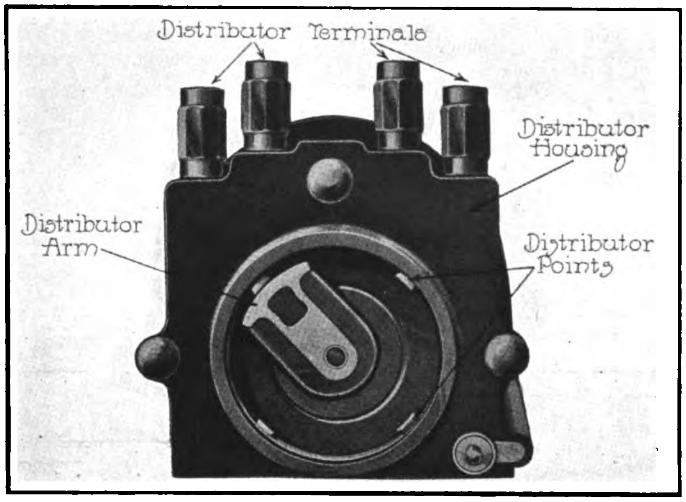


Fig. 60—Components Utilized in Distributing the High-Tension Current in the Remy Inductor Type of Magneto.

voltage current into high and its distribution to the spark plugs of the motor cylinders is next in order. While the construction of magnetos will vary in some respects, in that in some the winding is stationary, while in others it rotates, the method of current production may be said to be practically the same.

Before discussing the collection and distribution of the current generated the different types of magnetos will be defined. The term high-tension is generally utilized and is somewhat misleading to the novice. Although a high-tension current is obtained ultimately in some types, it is secured through the utilization of a transformer coil, while with others the building-up of the primary circuit is by means of a secondary winding contained within the instrument itself.

Magnetos Defined.

With the latter, or true high-tension type, the coil is eliminated, also a number of wires necessary with the other system. That the true high-tension instrument makes for simplicity is apparent when it is considered that in addition to the leads to the spark plugs, it requires only one other wire, that employed to ground the primary current, or in other words, to cut out the secondary current. This connection from the breaker box to the switch, thence to ground, differs from the battery and coil ignition in that the circuit is open when the use of the magneto is desired, while with the other system the circuit must be closed or completed to obtain operation. The open and closed types of switches utilized with the various magnetos will be explained in logical sequence.

With the low-tension magneto, so designated in this discussion to prevent confusing the reader, the primary current is collected and led to a transformer coil, where it is built up or strengthened, returning to the magneto, where it is distributed to the proper spark plug. The makers of both types advance able arguments in behalf of their product and their claims will be presented in the discussions of the different designs.

Magnetos utilized for ignition may also be classified in two groups, according to the basic principles employed in the magnetic field to produce the primary current, these being known as the armature and the inductor types. The armature type may be subdivided into two classes, simple and compound, the former including those designs which utilize a transformer coil, and the latter a double winding, or the true high-tension instrument. With the armature type the wire is wound around the core, and as the construction rotates between the pole pieces of the magnets the electrical impulses are set up within the winding. The primary current is collected from the armature by collector rings, brushes, etc.

The inductor type of magneto differs very materially. With this design the winding is held stationary between the pole pieces, on either side of which revolves a steel inductor. The construction eliminates brushes, collector rings, etc., and the manufacturer lays great emphasis on the design, pointing out that it is not only rugged, but makes for simplicity as well. With the inductor type of magneto it is possible

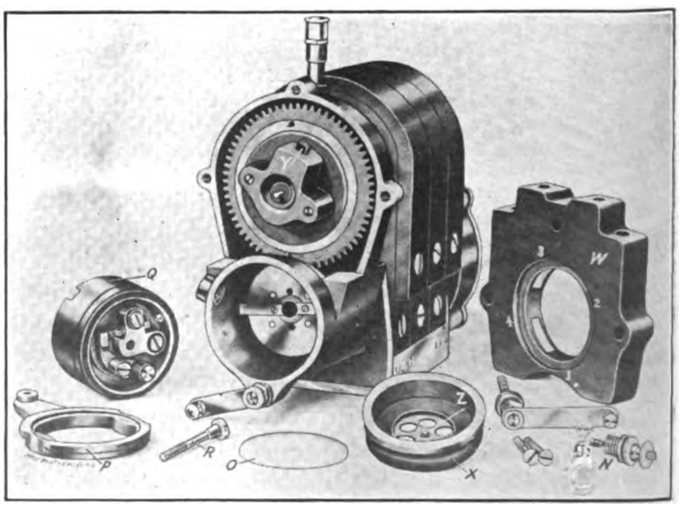


Fig. 61—Distributor End of U & H Magneto with Distributor Housing Removed to Illustrate Method of Assembly.

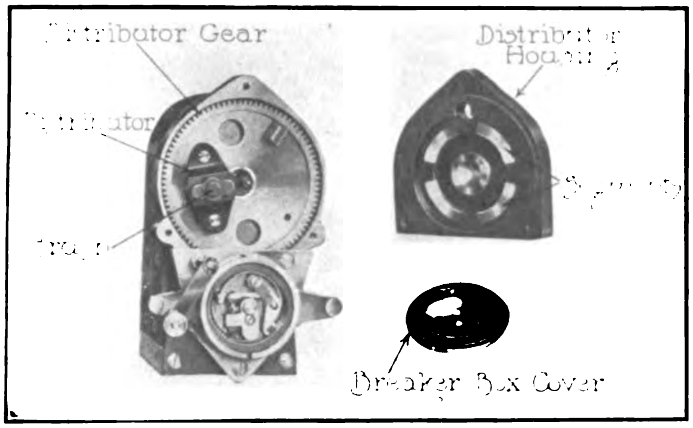


Fig. 62—Conventional Type of Magneto Employing a Wipe Contact—The Distributor Housing Is Displaced to Show the Segments.

to incorporate the secondary winding and obtain the same results as with the true high-tension instrument; in fact, when so arranged, it is a true high-tension.

Function of the Condenser.

Reference has been made to the condenser, a wiring plan of which was shown at Fig. 56 B. As previously explained, when an electric current flows through a wire it induces a current in any wire parallel to it. This is true in the case of two separate windings, as in the double windings of an armature, and it also applies to the various turns of the same winding. The action is termed self-induction, which has been previously discussed, taking place approximately when the primary circuit is broken by the make and break mechanism, and upon the current attaining its maximum value, or when the greatest number of lines of force is cut. Upon the separation of the contact points there is what may be termed an extra current over and above the initial impulse, and caused by self-induction. As a high electrical pressure exists when the contact points separate, considerable heat is present and the high temperature would soon burn away the platinum were it not for the condenser, the object of which is to prevent burning or to absorb the surplus energy of the spark.

Operation of Condenser.

It consists of two sets of tinfoil sheets, each insulated from the next, but connected to each alternate one. This places in compact form two large sheets of tinfoil separated from each other by a sheet of mica. One set of sheets is connected to one end of the primary and the second is fastened to the other end, the wires being continued to the make and break mechanism as shown at Fig. 56 B. This construction is termed parallel. When contact of the platinum points is broken, the current flows toward the gap, but as there is less resistance existing in its passage to and in the condenser, it is absorbed in this device. The energy is not lost, however, for when contact is re-established at the platinum points the current flows from the condenser, joining the newly generated electricity in the primary winding and adding to its strength. The principle of the condenser is similar to that of the induction coil which is utilized with the battery system of ignition.

The Distributor.

Irrespective of the method utilized to collect the current generated by the magneto, it is highly important that the transformed or induced electricity be properly distributed; that is, that the spark be produced at the gap of the spark plug when the piston of the cylinder has compressed the gas and is ready to begin the firing or impulse stroke. It has been pointed out that with a four-cycle, single-cylinder motor the points in the breaker box of a magneto separate only once in a complete revolution of the armature shaft. Consequently but one spark is obtained. With a four-cycle, four or six-cylinder engine it is essential that means be provided whereby the high-tension current will be distributed to the various plugs in the proper order.

The four-cylinder motor, for example, requires one spark for each cylinder for every two revolutions of the crankshaft, a total of four sparks. With the magneto, that is, the armature shaft, driven at crankshaft speed and with two interruptions of the primary circuit by the circuit breaker mechanism, it is obvious that only two sparks are obtained each revolution. As the crankshaft of the motor makes two complete revolutions, as does the armature of the magneto, it will be seen that it is necessary to utilize some means for obtaining a proper reduction between the armature shaft and the driven distributor, else the spark would not occur at the proper instant. This will readily be

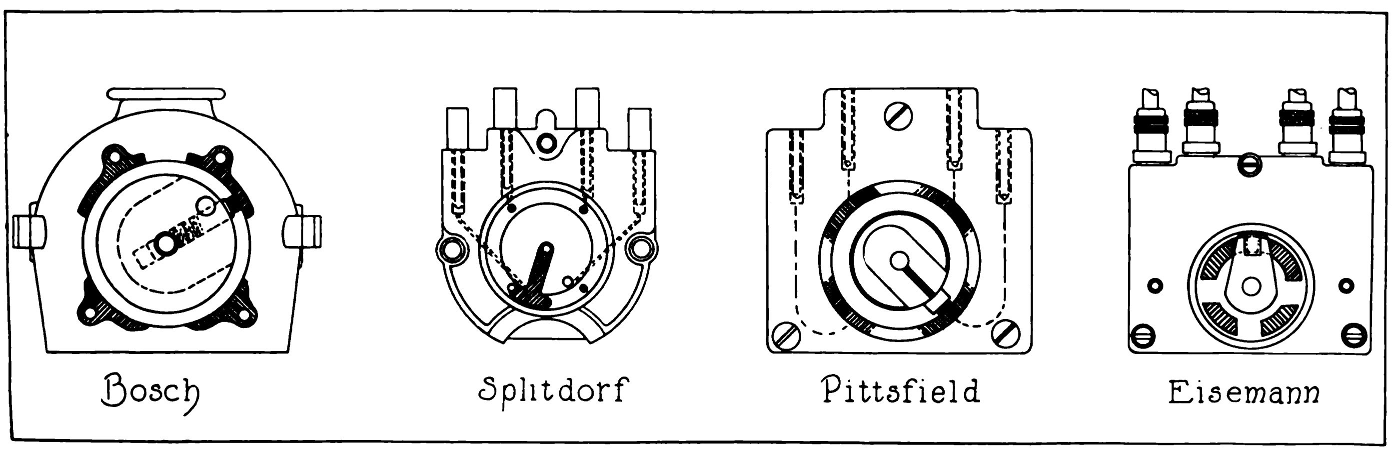


Fig. 63—Distributor Components of Conventional Types of Magnetos, also Connections Between Segments and Terminals.

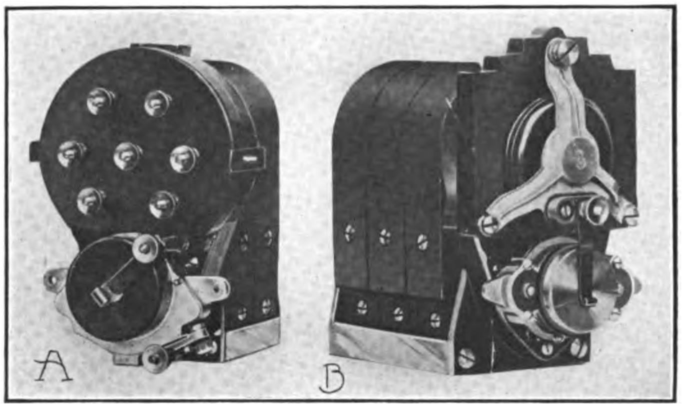


Fig. 64—Types of Bosch Magnetos: A, Six-Cylinder Unit with Terminals on Face of Distributor Housing; B, Four-Cylinder Instrument.

understood when the strokes of a four-cycle motor are taken into consideration.

The function of the distributor and its driving gears is that of properly distributing the high-tension impulses. While there are different forms, the principle involved is similar. By referring to Fig. 61, which shows the U & H magneto, with its distributor housing removed, it will be noted that there is incorporated a large gear, which meshes with a similar member secured on the armature shaft. These gears are in the ratio 2:1, or in other words, the large gear makes one complete revolution to two of the smaller member. Therefore, if the armature shaft makes two complete revolutions, the large gear will make but one. It is this arrangement that obtains the proper distribution of the high-tension current. Similar distributor gearing is employed with two, three and six-cylinder motors. The ratio of drive between the engine and the magneto, however, differs in two-cycle motors. As the relation of the speed of the crankshaft to that of the armature shaft has been explained, further comment is unnecessary.

The large distributor gear is of metal, usually brass or bronze, and attached to and revolving with it is the distributor arm, having a brush or similar construction, which makes contact with segments in the distributor housing. The number of segments corresponds to the number of cylinders, there being four for a four-cylinder motor, six for a six-cylinder, etc. The plate carrying the distributor gear is composed of hard rubber or compositions, non-conductors of electricity, to prevent the high-tension current from passing to any metal part of the magneto other than the segments. Particular attention is paid to the plate, etc., as the tendency of the secondary current is to flow where the least resistance is encountered.

Included in the distributor mechanism is the distributor housing, which is also a non-conductor of electricity. This housing is so made that it may be removed, the construction varying somewhat, but the principle being similar. It is secured to the body of the magneto by screws, clips or clamps, and imbedded in it are the metal segments of a circle. Secured to each of these is a wire or cable, which is led to a recess in which the distributor terminal is inserted. The connections between the segments and the terminals are shown at Fig. 63, the drawings also showing conventional types of distributors, distributor arms and bushes.

The construction of the distributor proper varies. In the U & H magneto shown at Fig. 61 the distributor arm is a brush, which makes contact with the metal segments imbedded in the member W. The Simms instrument illustrated at Fig. 62 utilizes a different arrangement, while the Remy, presented at Fig. 60, does not employ a wipe or brush contact. With this instrument the distributor arm is a triangular piece of brass molded in a material called Bakelite, a special composition noted for its high dielectric strength and non-hygroscopic qualities. The arm in revolving does not touch the small brass points in the housing, and it is pointed out that the construction increases the intensity of the spark, as well as eliminates opportunity for short circuits.

When contact is made between the brush of the distributor arm and a segment, or in the case of the Remy instrument, when the arm is opposite the brass point in the housing, the high-tension current flows through the metal and connection to the terminal, thence to the spark plug. It will be noted that the segments of the distributor are placed equidistant or 90 degrees apart with the four-cylinder unit and 60 degrees with the six, the number employed corresponding to cylinders of the motor. The different forms of distributor housings and methods of retention are shown in accompanying illustrations. Some of the improved types are presented, such as the Bosch at Fig. 66. In the perfection of the magneto the manufacturer has incorporated improved terminals and water and dust proof features, which will be discussed with the presentation of each type.

Safety Spark Gap.

With some types of magneto the true high-tension, for example, a device known as the safety gap is incorporated. It may be compared to the safety valve utilized with steam installations, which provides for the release of a portion of the steam when the pressure exceeds a predetermined amount. Owing to the char-

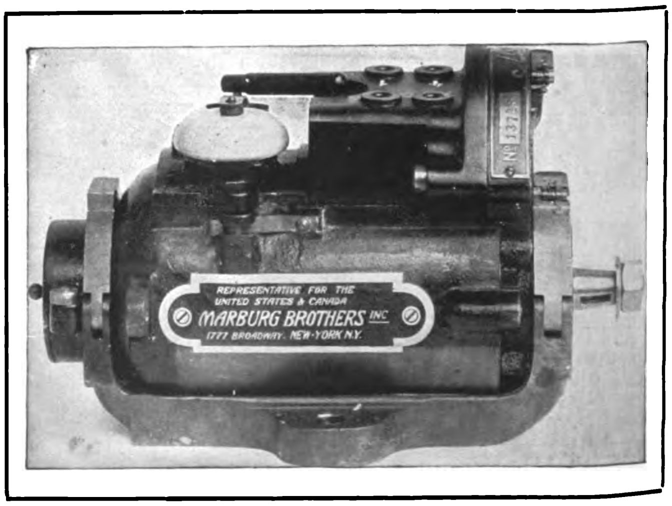


Fig. 65—Location of the Distributor Terminals of the Mea, Utilizing Bell Shaped Magnets.

acter of the high-tension or secondary current, if by chance a wire leading to a spark plug should become broken, the pressure of the electricity in the windings would be sufficient to break down the insulation in seeking a short path to ground.

The safety gap is employed to guard against damage from this cause, and as the name implies, comprises a space in a connection between the high-tension collecting brush and the ground represented by the metal housing of the magneto. As long as a current can pass over a gap having less resistance than that of the air space between the safety spark gap points, as in normal operation, the spark gap is inoperative. Should a wire become broken or disconnected at a plug, etc., and sufficient current be generated to damage the windings, the pressure is high enough to allow the energy to overcome the resistance of the air gap and pass to the ground. In order to prevent the ignition of any gasoline vapors that might be present in proximity to the magneto, the safety spark gap is enclosed in a small cage of wire gauze and is covered with a porcelain cap.

(To Be Continued.)

Ed. Note—The next installment will deal with the inductor type of magneto, outlining its components and operation, also presenting wiring diagrams.

REOS TRANSPORT NITROGLYCERINE.

Fleet of 12 Equipped with Specially Designed Bodies Readily Convertible When Desired.

The Independent Torpedo Company, Findlay, O., has placed in commission 12 Reo roadsters, made by the Reo Motor Car Company, Detroit, each of 20 horsepower, for delivering nitroglycerine. The explosive is carried in a detachable open body specially designed by the torpedo company for this specific purpose so as to admit of the machine being easily converted into a light and speedy car for their salesmen or official staff.

The fleet will cover Ohio, Indiana, Illinois, Kansas and Oklahoma, with possibly two or three other states adjoining this field. A large two-ton Reo motor truck is used an an auxiliary for hauling nitroglycerine from one factory to another.

HAULAGE COST 66.7 CENTS A TON.

Expense for Operating a Three-Ton KisselKar Truck in Packing House Service.

The Plankinton Packing Company, Milwaukee, Wis., has in its service a three-ton KisselKar truck, and a statement of the cost of operating it for the year ending June 10, 1913, shows that during that period the haulage expense was 66.7 cents a ton, figuring depreciation at 15 per cent. This estimates the life of the truck to be six years and eight months, or practically 20 months longer than the generally accepted term that a truck will be serviceable. Much, of course, depends upon the care and attention given.

In considering this statement it will be noted that the truck was worked 305 days out of 312 possible; that it was driven 7393 miles and carried 6,574,474 pounds, or approximately 3287 tons. The cost for labor, fuel, oil and supplies was 34.5 cents a ton; for repairs (including tires and the daily washing required by the government regulations), 11.2 cents a ton, and for interest, insurance and depreciation, 21 cents a ton. The truck carried each ton an average of 2.25 miles, and the average price of operation was 29 cents a mile. The subjoined statement is worthy of careful scrutiny:

Total number of possible days				312
Actual days worked				305
Miles				7,393
Weight handled, pounds				6,574,474
Power (fuel)	192.07		0.058	
	Total		A Ton	
Labor	$863.34		$0.263	
Power (fuel)	192.07		0.058	
Oil	50.06		0.015	
Supplies	28.09		0.009	
Total		$1133.56		$0.345
Engine repairs	$0.85		$0.000	
Transmission	2.50		0.001	
Tire repairs	214.08		0.065	
Other repairs	150.46		0.046	
Total		$367.89		$0.112
Interest and insurance	$239.72		$0.073	
Depreciation (15 per cent.)	449.80		0.137	
Total		$689.52		$0.210
Grand total		$2190.97		$0.667
Total number of hours				3044.75
Number of stops				4543
Pounds a stop				1447
Total number gallons fuel				1622.50
Miles a gallon				4.56
Cost a mile				$0.29
Total cost a day				$7.18
Miles a ton				2.25
Total number trips				1193

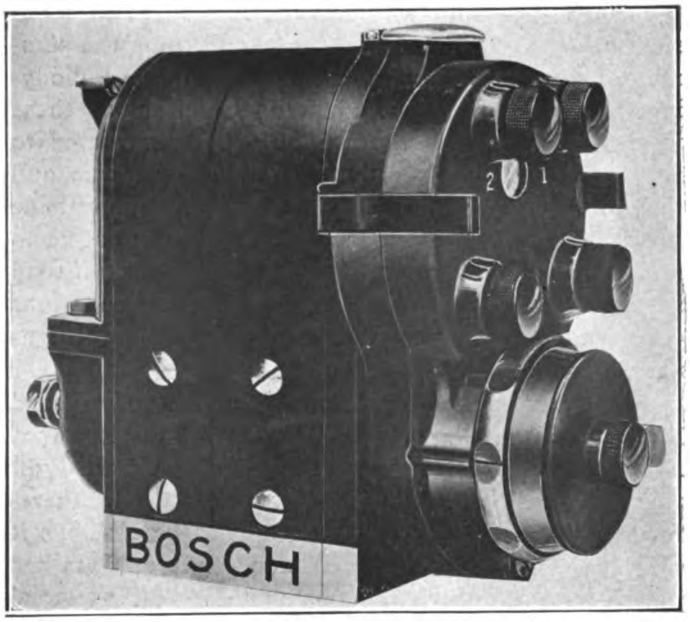


Fig. 66—Method of Retaining Distributor Housing of Bosch Having a Timing Window.

The item above under "other repairs" includes daily washing of truck required by government regulations at a cost of 35 cents a day.

INTERNATIONAL ROAD CONGRESS RESULTS.

MUCH time was devoted to subjects intimately connected with the use of motor vehicles at the third international road congress, which convened recently in London, England. The keynote may be said to have been sounded by Lloyd George of England in his speech of welcome, in which he referred to the revolution which has come about in the use of roads through the development of motor traffic. He did not think this a matter to be deplored, for the more communication was improved the less was spent on distribution, and the more was available for production. Bad roads, he declared, meant a horse taken away from the plow and attached to a cart.

Accredited delegates were present from 39 governments, representing practically every civilized country in the world. As is usual with such gatherings much of the business was transacted in sections and by subcommittees.

The first section was devoted largely to the consideration of reports from nations concerning the planning of new roads and streets, and resolutions embodying the suggestions were adopted. Chief among these were that new main roads should be constructed to pass outside rather than through cities and towns, and that the planning of main road communication outside towns should be undertaken at once, the initiative to rest with a central state authority. The subject of road surfacing also was taken up and recommendations covering wood block paving, and asphalt for bridges and easy gradients, were adopted.

The second section took up the matter of road lighting. It was decided that it was quite clear that as country villages and urban districts could not light the roads in a way adequate for modern traffic, therefore the user must carry his light with him. Thus it will be seen that the international road congress has placed its seal of approval on the subject of universal lighting, so-called. It also was decided that motor lights should be proportionate to the speed and should enable the driver to see an obstruction at least twice as far off as the distance in which his brakes could pull him up. Resolutions were adopted that in inhabited places the headlight should be limited to the illuminating power of an ordinary lamp, and that one color should be adopted as a danger signal.

The third section took up the question of highway administration. The reports from the different nations showed a greater tendency toward larger centralization. It was decided that the task of constructing roads should be placed in the hands of larger units than the local authority. A Belgian delegate advocated the state control of all roads, but the conclusion reached was that it was difficult to make one rule which would apply to all countries.

The business of the congress naturally covered a wide range, and it would prove impractical to review the entire proceedings here, were it possible to condense all the various reports and papers presented. The general principle of the following conclusions was approved:

1—The expenditure on the maintenance and improvement of (a) the roads which serve as main routes of communication between important places in any country or (b) the roads which are used mainly by long distance traffic, unless such expenditure is borne wholly out of national revenues under a system of state administration of roads (which system is practicable and suitable in the case of some roads in some countries), should be mainly paid out of the national revenues, whether or not such roads are locally administered and maintained, subject, where local administration prevails, to the supervision of a central government authority both as to efficiency and expenditure.

2—It is desirable to abolish, so far as possible, all tolls on public roads, but it is equitable that the owners of vehicles which, on account of their weight or weight combined with speed or any other exceptional circumstances connected with either the vehicle or the use of the road, cause special damage to roads beyond the wear and tear of the ordinary traffic of any district should be subject to special taxation, the proceeds of which should be earmarked for expenditure on roads.

3—Borrowing money for new road construction and for the periodic renewal of the surface coating of a road is consistent with sound financial principles, provided that the loan period in the case of loans for renewals is kept well within the life of the surface coating.

Another important point discussed was that dealing with the construction of macadam ways bound with tarry, bituminous or asphalted materials. This occupied much time and brought out many interesting details. The main decision reached was that it was important, both in the interests of the duration of the road and the comfort of the users, that repairs should be made immediately a defect showed itself. Concerning the main proposition, a Russian delegate suggested that a committee be appointed to investigate the various methods used in different parts of the world and report at the next congress.

In the matter of traffic regulations the following conclusions, as prepared by Lord Montagu of England, editor of The Car and an international motorist of note, were adopted after long discussion:

1—That all regulations for the control of road traffic should be based on the principle of allowing the speed practicable for each different kind of vehicle consistent with public safety, general convenience and the normal wear of the roads.

2—That regulations for the conduct of fast and slow traffic should be as few and simple as possible, and should be such as can and ought to be universally adhered to and enforced.

3—That in large cities there should be a traffic authority on whom should be charged the duty of studying and dealing with street traffic problems, the powers of such authority and the co-ordination of such powers with those of other public authorities being matters of detail which must be settled by public authorities on consideration of the circumstances and conditions of each large city.

4—That there should be ample provision of traffic controllers (such as the police in London) with adequate powers to regulate the traffic, not only at congested points, but throughout the course of crowded streets.

5—That having regard to the increased danger which is necessarily created by the conditions of modern traffic, it is important that drivers should be carefully and systematically trained, and that children should be specially taught how to provide against the dangers of the road.

6—That except where local circumstances render it absolutely necessary, no obstructions, such as lamp posts, tramway standards, etc., should be placed in the centre of the road, except necessary refuges for pedestrian crossing.

7—No obstruction of the public highway should be permitted either by vehicles standing unreasonably, or by things placed on the highway. Exception must, however, be made for depots required for the work of maintenance or repair of the road, and for work being carried out by duly authorized and competent authorities, but in every case all necessary steps must be taken to insure the safety of traffic.

8—That regulations for roads and traffic must aim at defining the rights, duties and responsibilities for each kind of traffic in order to avoid the causes of accidents and damage, and to insure the maximum of order and liberty.

MOTOR TRUCKS IN CONTRACTORS' USE.

High Efficiency of Machines Used by Hugh Nawn Construction Company in Building New Boston Subways—With Large Estimates for Operating, Economy Is Shown.

THE largest and most important work now in progress in Boston, and probably in New England, is the building of the four sections of the subway from Park street to the convergence of Beacon street and Commonwealth avenue, and the two sections of the Dorchester subway, which is projected from Summer street to Andrews square, the Hugh Nawn Construction Company having contracts for the six different jobs. The subways are additions to the system now utilized for rapid transit by electric railways, and are in every sense municipal work. The subways are authorized by legislation, and the engineering is done under the direction of the commissions having supervision of construction. The expense is borne by the city, and the subways, when completed, will be leased for long periods to the Boston Elevated Railroad Company, which now has leases of the other sections of the Boston subway system.

The Hugh Nawn Construction Company, and prior to the organization of that company the business conducted by Hugh Nawn, has been known to Bostonians for more than a generation, and the headquarters are at Maple street, Roxbury. This concern is a specialist in excavation and foundation work, and this may mean anything from the construction of a sea wall to the bed on which a skyscraper may be supported. The company has built but one structure, the Cambridge car house of the Boston Elevated Railroad, but all of its work aside from this has been practically on or beneath the surface of the ground. Very frequently the company will have contract to make excavation and put in the foundation up to or about the level of the grade, and from this point the work will be taken up by other contractors.

Seven-Ton Mack Truck Used by the Hugh Nawn Construction Company, Boston, Mass., in the Haulage of Crushed Stone and Sand.

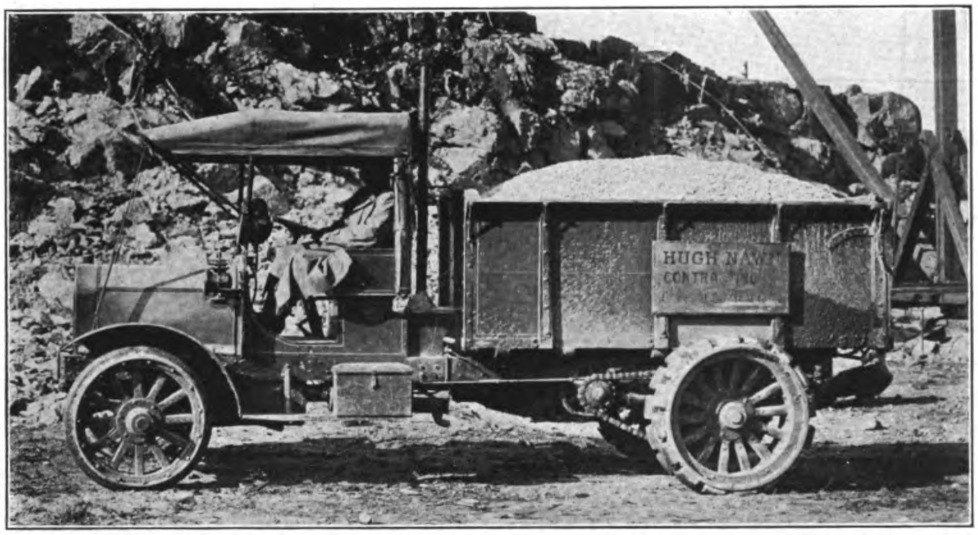
Emphasis is made of the character of work because it is essential that the company have transportation equipment of unusual capacity. The excavated rock and soil must be removed, even though a part of it is to be used later for filling, and all of the heavy stone and metal and the different materials utilized must be brought to the job. The company has need of large quantities of crushed stone for making concrete, which is very generally used in construction, and it has two stone crushers, the one at Dorchester and the other at Jamaica Plain, as well as a large gravel bank at Sharon Heights, Mass., about 15 miles from Boston, on the main line of the New Haven railroad. The resources are mentioned to demonstrate the proportions of the company. Just now it has about 400 men working on the two subway sections.

The subways are opened from the street, and the big trenches are sunk to the levels specified in the contracts, being dug to such depths as will insure solid foundation. That the traffic may not be impeded unnecessarily in the streets that are opened the trenches are bridged with timber of such strength as will support two-horse vehicles and loads, and the walls are protected from caving in by sheathing braced by timber. The subway structure itself is laid in the trench in the form of concrete that is made of crushed stone, sand and cement, and it is formed in molds, the sections being locked together at the joints by what may be described as dovetailing. When the structure has been completed the trench is filled to the level of the street grade, the earth consolidated and the paving relaid. This work is less expensive than tunnelling, and for the Boston subway system it gives every required result.

From the above brief description it will be understood that the amount of haulage necessary in connection with such a contract is very large. The Boylston street subway as projected is approximately 8000 feet long, and the Dorchester subway about 13,500 feet in length, or about 1.5 and 2.5 miles, respectively. All of the excavated rock and soil cannot be placed in the street and must be removed, the timber for the sheathing and bracing must be hauled, the materials for the concrete for the structure itself must be drawn and, after mixing, distributed along the work, and later the filling and paving is similarly transported. Were the

different contracts held by different concerns, work on all sections would be in progress simultaneously, and finally each would be joined, but as one company has the contract, so great a section of the city is not affected, for, incidentally, a great deal of temporary building has been necessary to provide for the street railways as well as the protection of the sewers, water mains, telephone and electric light conduits, and the like.

The little plaza at Copley square between Huntington avenue and Boylston and Dartmouth streets has been given over by the city to the company for use as a construction yard, and at this point has been erected a number of portable buildings, as well as a pair of mixing machines, by which the concrete for use in both subways is mixed. The work begins in Boylston street at 8 Monday morning and is continued without interruption until 5 Saturday afternoon, while in the Dorchester subway it never ceases. The two mixing machines, driven by portable steam engines, are whirling practically all the the time save from Saturday night until Monday morning, and every 24 hours approximately 500 tons of concrete is made and hauled.



Five-Ton Peerless Truck Loaded at the Stone-Crushing Plant of the Hugh Nawn Construction Company, Dorchester.

The stone is brought from the crushers and the sand from Dorchester, where it is received in cars from the Sharon sand bank, while the cement is brought in by the carload and is hauled to the yard. The company now has in service five trucks, four that it owns and one that it has hired, with the services of the man who owns it, and 25 two-horse teams and carts hauling stone, sand and cement, and it has other two-horse teams and carts and Watson dumping wagons hauling the cement and the excavated material.

The company has owned five trucks, the first being a three-ton White machine that was worked for 16 months and then sold because it did not have the capacity desired, and about a year ago three Mack trucks, one five-ton and the others seven tons, were bought. Eight months ago a five-ton Peerless machine was purchased, and these four are now in use. The hired truck is a five-ton Pierce-Arrow, which is driven by the owner.

The trucks were bought for two reasons, the one being that they could be used in the subway construction, and that the company does a considerable business in crushed stone which must be delivered. This is outside of its contracts. It was expected that the machines could be used to excellent advantage for stone haulage aside from work actually done on the subways, and while the purchase was impelled by the contracts they were bought with a view to service after these were completed. All of the machines are fitted with bodies that will hold approximately the capacity load of either sand or stone, and these have power hoists for quick discharging.

The round trip from the Dorchester crusher and the siding where the sand is received by railroad car to the Copley square yard is approximately nine miles, and it is about seven miles to the Jamaica Plain crusher and return. The trucks have averaged during the time they have been in service about 58 miles each day, carrying capacity loads half the distance.

All of these trucks are equipped with steel bodies, and as the loading and unloading is by gravity, comparatively little time is wasted at either end. This may be learned by analyzing the figures, which show that working 10 hours daily without stops the machines must make 5.8 miles an hour, and with an hour's allowance for loading and unloading this would give 6.44 miles an hour all of the nine hours they are on the road. Considering the hour specified, this would give three or four minutes at the yard and the crusher each trip, not unreasonable when it is understood that the horse wagons must be loaded and unloaded and congestion cannot be avoided, no matter how carefully the work is planned.

There are times, however, when the machines are worked from 14 to 15 hours each day, which would not be possible with any other form of transportation, and then the mileage accumulates very rapidly. Each of the seven-ton trucks makes in the ordinary day's work 58 miles, 29 miles loaded with seven tons, this being 203 ton-miles daily. This is an average of 7.25 miles to the round trip, or 3.62 miles loaded to the trip, or 25.375 ton-miles for the seven-ton trucks. The five-ton truck is driven the same distance and shows 145 ton-miles daily, this making 18.125 ton-miles for each trip.

It will be understood that the larger ton-mileage of the seven-ton machines shows striking proportions, in the aggregate, but this is to be expected

though the smaller truck is worked to its capacity constantly. Its work is stated as an average, and not with a purpose to make an unusual showing, yet in three weeks last November the Peerless truck was driven 1124 miles, an average of 63 daily, during which time it delivered from the crushers to the Copley square yard 1,590,010 pounds of stone, an average of 88,333 pounds a day. The working time for the day was nine hours and 30 minutes and the average speed was 6.66 miles an hour, including stops.

In arriving at cost figures it may be explained that Harry Nawn, who has charge of the transportation for the company, states that he has placed his estimates for truck expense high. He maintains that $20 a day assumed for the company's equipment is a not unreasonable cost for a seven-ton truck, and he has applied this to both the seven and the five-ton machines. He figures depreciation at 20 per cent. of the cost price annually, so that five years wipes out the entire investment. He estimates that the five-ton truck is equal to three pairs of horses, and the seven-ton truck equal to more than three pairs of animals.

Taking $20 as the daily cost and the average of 203 ton-miles for the seven-ton machine, it will be seen that the cost is 9.82 cents a ton-mile, and taking the five-ton machine on the same basis, the cost is 13.76 cents a ton-mile. But it is exceedingly probable that these figures will be somewhat reduced by a careful consideration of the factors.

Mr. Nawn says that his horses cost him, for a two-horse team, cart and driver, $4.92 a day, which is apparently a very low figure, but this can be attributed to the fact that the overhead is exceedingly small, the matter of appearance is not thought of, and the equipment is relatively large. The horses are generally first-rate animals, always large, and are kept in condition to do hard work, but they are not worked the entire year round as a rule, and have opportunity to recuperate during the winter months, from January until April there being comparatively little done in outdoor construction. The stables are located where the cost is relatively small, the administration and maintenance charges are minimized, and the expenses generally are low. It will be seen that with an allowance of $2 a day for a driver, $2 a day for stabling, feed, bedding, shoeing, veterinary service, supplies, etc., this leaves 92 cents for depreciation, insurance, taxes, repairs, administration and other expenses that may be incurred.

The prevailing price for a hired two-horse team, cart and the services of a driver in Boston and vicinity is $6 a day, and as this is expected to cover all expense and leave a reasonable margin of profit for the owner it will be seen that the difference of $1.08 between that and the cost to the Nawn company is 21.95 per cent., which is not large.

Relative to the cost of $20 a day for a machine, this is approximately 33 per cent. more than is fixed by general acceptance, and while it may be maintained that this is excessive and does not fairly represent the productiveness of the machine, it will also be admitted that with this as a basis of judgment there is no probability of any expense not being provided for. Mr. Nawn makes the statement that there is comparatively little difference between the cost of the five and the seven-ton machines, but this is seemingly paradoxical, for there will be variance with reference to investment, depreciation, interest, insurance, taxes, fuel, oil and tire cost, as well as garage and maintenance expense. It is true that the wages of the drivers will vary but little, and relatively the smaller vehicle ought not to be as productive as the larger, but this ought to be somewhat equalized by the greater speed of the machine. In the three weeks' work instanced it will be seen that the five-ton truck made an average of 63 miles daily, and it carried 44 tons daily, this during a working day of 9.5 hours. Placing this against the average, it will be seen that the cost a ton haulage was considerably reduced.

The Pierce-Arrow Five-Ton Truck Rented by the Hugh Nawn Company and Used for the Cartage of Cement—This Machine Has Carried 120 Tons .75 Mile in Less Than 10 Hours.

The round trip to the Dorchester crusher is nine miles, and to the Jamaica Plain crusher seven, and two round trips are practically as much as a team of horses can do. Taking a horse load as five tons, which is probably more than the average, two trips to Jamaica Plain would be 14 miles, one trip to each yard would be 16 miles, and two trips to Dorchester would be 18 miles. First taking the horse teams and allowing them five-ton loads, the cost for hauling two Jamaica Plain trips would be at $4.92 daily 70.3 cents a mile, loaded, or 35.14 cents a mile for the round trip for 14 miles a day. Making one trip to each of the crushers would cost 61.5 cents a mile loaded, or 30.75

cents for the round trip of 16 miles, and making two trips to Dorchester would cost 54.6 cents a mile loaded, or 27.33 cents a mile for the round trip of 18 miles.

The trucks make eight trips a day, which is assumedly to Jamaica Plain, and allowing the cost to be $20 a day for each machine, this gives a mileage expense of 68.9 cents a mile loaded, or 34.48 cents for the round trip of 14 miles. Taking the three seven-ton trucks, however, it will be seen that the actual cost of hauling a load is 24.62 cents a mile, considering the greater capacity. In other words, where the trucks are rated as having the same cost and both sizes can haul a full load for 68.9 cents a mile, the actual expense, based on the cost of the five-ton machine, is materially less for the seven-ton vehicles, as their load is 40 per cent. more. That is to say, that with a cost of 68.9 cents a mile for 29 miles a day, carrying a load of seven tons, the ton-mile expense for the larger trucks is 9.82 cents, and carrying a load of five tons the ton-mile expense for the small truck is 13.76 cents. Taking the teams with the hauls of seven, eight and nine miles loaded the cost is, respectively, 14.06, 12.30 and 10.93 cents a ton-mile. The figures as to mileage, however, show that trucks each are driven practically four times the mileage of the horse teams, and seemingly each does work equal to four teams, at least so far as mileage is concerned, with at least equal tonnage. On this basis the estimate of expense would appear to be four times the cost of a horse team, which is $19.68. The capacity of four teams, however, in this work, is 40 tons of sand or stone a day, which is equalled by the small truck, and exceeded by 16 tons, or 40 per cent., by the larger trucks. Regarded from this angle it would appear there is an element of economy that is not apparent from the bald statement of $20 a day cost, and being equal to three pairs of horses. Incidentally it may be stated that no valuation is placed on the reserve capacity of the trucks, which might in the event of need be worked constantly with changes of drivers.

The company has its own garage, which was built for storing the machines, and it is well equipped and has the conveniences and facilities that are essential to good attention. When the trucks were purchased a mechanic was employed to do all mechanical work necessary on them, including adjustments, replacements and repairs, to generally maintain them and keep them in condition for service, but this was not regarded as satisfactory, so a change was made. Instead of having the drivers simply qualified for driving the trucks, men who have had mechanical experience are hired, it being understood that their duty is to drive the number of hours the machines are worked, and after working hours they are expected to do whatever minor mechanical work may be necessary. That is, these men do practically all the ordinary work, making adjustments, ordinary replacements, as well as keeping the machines cleaned, oiled, greased, and replenishing the fuel, water and lubricant. One of these men is more experienced than the others and he is required to supervise whatever work is performed on the machines.

These men work evenings and Sundays on the trucks, receiving pay for whatever time is given over to maintenance work, while once a week the machines are thoroughly inspected by experts from the service departments of the makers of the trucks. By this system the trucks are kept in excellent condition and their efficiency is assured. In the event of work being needed that cannot be done by the drivers, the machines are sent to the service stations of the builders and there whatever is necessary is done by men familiar with them, who can be regarded as experts.

The company, besides its own work, supplies customers with crushed stone and sand within a radius of approximately six miles, although under some circumstances delivery might be made a greater distance. The company, by operating its own crushers, makes the profit that would be made by a stone dealer did it purchase its material, and the surplus, after its own needs are supplies, is distributed. It is used for construction, road building and landscape work, and its use is becoming more general every day. For this delivery the trucks have distinct advantage over horses, especially where the needs are urgent, and can afford much better service. In this respect they are a convenience and serve a decidedly useful purpose, eliminating the element of expense entirely.

The hired Pierce-Arrow truck in the service of the Hugh Nawn Construction Company has a crew of two men, and this is used exclusively to haul cement in bags from a railroad yard to the construction yard at Copley square, a distance of .75 mile. The crew load the truck at the railroad yard, but it is unloaded by a gang of helpers at the end of the trip. The truck has a platform body and quick loading and unloading is not possible; that is, gravity handling. As the cement must be taken from the cars and piled on the truck, and it is removed from the truck and stacked in sheds in the construction yard, time is required at either end of the trip. In the event of rain more time is required, as the cement must be protected from water. An example of the efficiency of this machine may be seen in the work of one day, when 24 loads of 100 bags, each bag weighing 100 pounds, were carried from the railroad yard to Copley square, this being a total of 120 tons. The time required was 10 hours, and the mileage was 36. Allowing approximately seven minutes for the run in either direction and seven minutes for loading and four minutes for unloading, this will account for every minute of the 10 hours of a day. The speed stated would be approximately 6.66 miles an hour which is probably about correct.

The owner of this machine keeps it in a public garage and gives it his own attention, so that it is not only well cared for, but it is not out of service. He has had a wide experience with trucks, and he drives, and insists upon those who are employed by him driving, with care. With him the machine is an investment, and upon its serviceability depends entirely his busi-

ness. He has owned other trucks and has learned by experience the better method of insuring productiveness.

Relative to tires, it should be stated that the trucks of the Nawn company are large size, seven-inch band tires being used on the forward wheels of the seven-ton trucks and seven-inch dual block tires on the rear wheels. These tires are guaranteed for 8000 miles, and they are giving very close to that mileage, generally somewhat in excess, with the rear shoes, while the forward tires will ordinarily yield considerably more than the guarantee. The fact that the tires are larger than are customarily used on such machines is the reason why satisfaction is given, while the machines are seldom, if ever, overloaded.

It may be pointed out in connection with this work that as the hauls are comparatively long, both horses and trucks each relatively make good showings, and as the loading and unloading is by gravity that the only advantage of the machines is their superior speed, greater reserve and larger capacity.

MAKING NITROGLYCERINE SAFE.

Special Equipment Fitted to White Wagon for Use in Oklahoma Oil Fields.

Handling high explosives is always dangerous, and transporting them by road vehicle may be regarded as being as great a risk for the driver as for the workmen using them, so when the Eastern Torpedo Company, Battlesville, Okla., decided to purchase a 1500-pound White wagon for delivery purposes it was necessary that the machine be specially adapted for the work. The company distributes nitroglycerine within a radius of 50 miles in the Oklahoma oil fields and the roads in many instances are to almost inaccessible places. There is very little of the highways that would be regarded as good, and the greater part can be very reasonably classed as rough cart paths.

The chassis was fitted with "soft" springs that are intended to be particularly easy in action and absorb the road shock, and pneumatic tires. The body is a special construction throughout. Crosswise and lengthwise of the frame are sills of heavy, long-leaf yellow pine that cover the entire loading space, and on this is built the compartment. First is a floor and then a layer of asbestos covered with a solid floor of pine. On this floor is a rubber mat, and on the mat is a copper pan with sides five inches in height. The asbestos is to prevent heat from the engine, exhaust pipe or muffler reaching the load, the rubber mat minimizes the shocks, and the copper pan is to retain the fluid and prevent its escape to the chassis should a can leak. The compartment is divided into 30 spaces seven inches square and 17 inches deep by poplar boards dovetailed together, and these are covered by a top in two sections, hinged at the front and rear, that can be locked at the centre. The body is 47.5 inches length, and back of this is a deck on which can be carried the reels for lowering the cans into the wells.

The loading and unloading may be done by the driver alone, and to facilitate handling by one man the right rear fender immediately above the wheel is made a step and running board on which the cans of explosive may be placed so that the driver may jump off unincumbered and without danger of jarring the can.

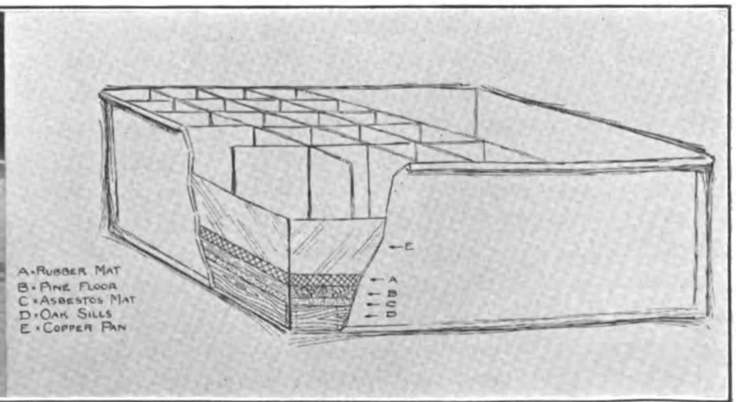
PACKARD AS STORE 'BUS.

Detroit Department Store Inaugurates New Service for Benefit of Its Patrons.

An innovation in progressive department store management in Detroit has been inaugurated by the Elliott-Taylor-Woolfenden Company of that city, which has established a free motor 'bus line from the Campus Martius, the main traffic centre of the city, to the store, half a mile distant, for the benefit of its patrons. Round trips are made on 15-minute schedule during shopping hours.

The vehicle consists of a Packard two-ton truck chassis equipped with a special 'bus body. Two rows of seats with a centre passageway provide for 22 persons. The interior finish is mahogany with dark green leather upholstered seats. The special equipment includes interior electric lights and cushion tires.

The 1500-Pound White Wagons in the Service of the Eastern Torpedo Company, Bartlesville, Okla.



The Special Body Designed for Use in Transporting Nitroglycerine in the Oil Fields of Oklahoma.

COAL DELIVERY BY MOTOR TRUCKS.

Careful Experiment Now Making by Metropolitan Coal Company of Boston, Largest Concern of the Kind in New England, to Determine Economy of Machines.

MUCH interest is manifested in the use the Metropolitan Coal Company, which is the largest coal dealer in Boston, and probably in New England, is making with electric vehicles in its delivery service in Boston. This concern was established many years ago and its business has developed with a view to serving the people more generally than does any other company, there being yards located in different sections of the city. Some of these yards are at the water front, for practically all of the coal is received by water shipments, often by barge or vessel load, and the distribution is made from these yards by wagon. The company has necessarily a very large equipment, this including about 600 horses and many wagons and carts, the greater part of the vehicles being of the two-horse team type, which have a normal capacity of from 3.5 to four tons, and some single-horse wagons that have a capacity of about two tons.

The delivery outfit of the company represents a very large amount of money, for good horses, such as

One of the Five-Ton Eldridge Front-Wheel Driven Carts Used by the Metropolitan Coal Company, Boston, Mass.

are used for heavy haulage, cannot be purchased for less than $350 each, and each pair, with cart and harness, is worth an average of $1000. Estimating the value of the single outfits on the same basis, although they will cost somewhat more, the total investment represented is not far from $300,000, to say nothing of the property value of the stables, and the other equipment incidental to the use of horses. Considering the entire delivery service of the company, it is not unreasonable to assume that it has an actual valuation of $400,000. As this capital does not produce anything, and no revenue can be credited to the company, it will be understood that it is desirable to keep the delivery expense to the lowest figure possible.

The business of the company is very large and the tonnage handled, including both anthracite and bituminous coal, will probably considerably exceed 1,000,000 tons annually. The company does both wholesale and retail selling, and the statement made relates to what may be regarded as local deliveries only. The yards were located with reference to economizing and conveniencing delivery, for distribution from one central point would necessitate longer haulage and greater cost than from the different places in the city. But water front locations are essential because of the receipts by vessel and the larger the cargoes the more advantageous the transportation charges.

With the enormous distribution and the need of supplying the customers promptly the value of equipment that will be economical and dependable can be understood. Having used horses for transportation for years, the company decided to make experiment with motor vehicles, and after careful consideration of the possibilities of mechanical wagons a Couple-Gear four-wheel driven truck of five tons capacity was purchased, delivery being taken in March, 1911. No change was made in the machine, but it was equipped with a body with the customary form of hand-operated hoist, such as are generally used on horse carts.

The intention was to experiment extensively with this machine, with a view of determining the cost of operating it in varied service, and to make comparison with the expense of making delivery with horses. The truck is a standard Couple-Gear construction, which is ordinarily equipped with a single battery, and has a capacity of approximately 35 miles, half the distance loaded. As the intention was to work it in what might be regarded as long hauls a second battery was ordered, which practically doubled the mileage of the machine when the conditions were such the battery could be changed.

As might be assumed, the introduction of the truck necessitated the keeping of records that would, it was believed, afford accurate information, but because of the rather unfavorable conditions, the comparison of a machine operated by men practically inexperienced with work accomplished by a large and highly efficient organization, it was not found possible to determine facts that could be accepted without question. As a matter of fact, considerable time was required to gain such knowledge of the truck as would make possible a full realization of its productiveness.

The machine was stationed at the Southampton street yard, which is at the north end of the Dorchester district of the city, from which deliveries are made a considerable distance. A garage was extemporized and a charging panel installed to charge the batteries, and a man detailed to supervise the charging and to give the other attention necessary. In this connection it should be understood that the cost of caring for the truck was, and is now, comparatively high, for one

man can attend a dozen machines without difficulty during a night, and this would minimize the proportionate expense. The truck was utilized for long hauls generally, but occasional experiments were made in delivering single and divided loads, so a very good idea was obtained of the possibilities with it.

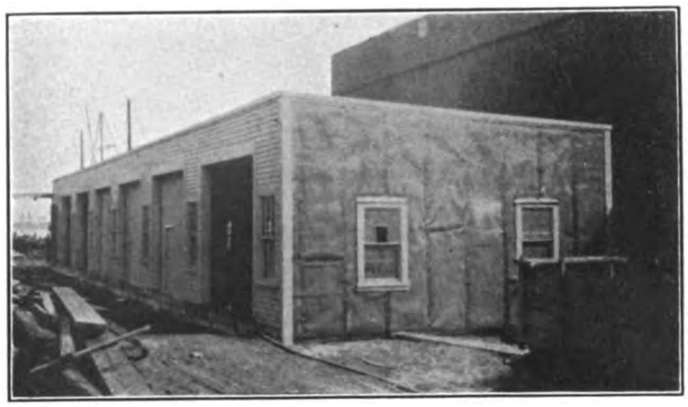
It was found that the truck could be worked to capacity the entire time it was in service each day, and that it had with a change of batteries a radius of movement that was equal to every requirement, and that during the severest winter weather the machine climbed every grade with full load and never failed, no matter how deep the snow or what the condition of streets. The results were such that the company decided to make further experiment, this time with the Eldridge front-wheel driven carts, these being so constructed that it was regarded as possible to utilize the horse carts. These machines are built with a forebody carrying the battery, driver's seat, controller, dash and footboards mounted on springs carried on an axle, which has two Couple-Gear wheels. To this is connected a body and rear wheels shod with steel tires. The battery capacity is rated as 25 to 30 miles, according to the character of the streets, and the maximum load is five tons.

From the viewpoint of the company, if this equipment was found practicable it would be possible to utilize the bodies, rear wheels and axles of a large number of the coal carts then in use, this being a very large saving when the value of the carts is considered, while the steel tires, if found practically serviceable, would mean a very large economy in operating expense when compared with the cost and the comparatively short life of rubber. These machines have not the mileage capacity of the four-wheel trucks without a change of batteries, but with spare battery equipment they may be worked so long as changes are made.

The first of these carts was received in January, 1912, and during the spring, summer and autumn five others were delivered, making a total of six now in service. In working these it was realized that it would be necessary to have facilities for storing and charging them, though until late in the summer the carts were kept at the Atlantic Avenue Electric Garage. At that time the company erected a garage building on its Summer street wharf, a wooden structure that is designed to allow further expansion, in which the machines are now housed, but the four-wheel driven truck is still stationed at and operated from the Southampton street yard.

The service given at the Atlantic Avenue Electric Garage was in every way satisfactory, for it is conducted by a committee representing the Electric Motor Car Club of Boston, and it was established to demonstrate the possibilities of such garages as private enterprises, but it was decided by the company that when it had six machines it was justified in establishing its own service station. The principal purpose to be accomplished was economy. The garage was equipped with a 50 horsepower 30 kilowatt motor generator, and a mechanic was engaged who has charge of the plant, charging the batteries at night, while during the noon hour the batteries are usually "boosted," this insuring the desired mileage.

The garage is a long, single-story structure that has a series of wide doors along the front side, and by opening these doors the machines may be backed into the bays or spaces for them, while they may be as readily driven out. The form of the building minimizes the work, eliminates the possibility of accident and obviates turning or moving a machine, either in the building or in the yard in front of it, and making it possible for any driver to take his machine into or from the garage without loss of time. There is sufficient room in the structure so that each cart may be worked upon without inconvenience, and there is abundant light. The charging installation will charge the six batteries at one time, and it is instantly available whenever current is needed. The equipment includes such tools as might be ordinarily needed in work on the carts, and it is possible to have special jobs done quickly in the event of emergency. A



The Garage for the Five-Ton Electric Eldridge Front-Wheel Driven Carts of the Metropolitan Coal Company, Summer Street Wharf, Boston, Mass.

stock of such parts as are required for replacements because of wear is carried, and a spare wheel and motor will permit repair of any wheel in comparatively short time.

The fore-wheel drive was adopted with a view of utilizing the bodies and rear wheels and axles of the horse carts, but while these have thus far been utilized, the experience of the company has not been favorable to such adaptation. This is due to the fact that the carts are driven at about twice the speed of horses, and the horse carts were not built heavy enough to withstand the extreme stresses of constant use on paving at the rate of five or six miles an hour. The construction of the carts is massive, but the components should be much heavier to endure the pounding they are subjected to with steel tires. While it is practical to use the horse carts for a time they cannot be sufficiently strengthened to be regarded as permanent equipment, and after they have been in service a short time it is necessary to repair them. Thereafter the maintenance expense is quite certain to be consider-

able. With bodies and wheels and axles specially built there is no reason to believe there will be any unusual cost of upkeep, but the use of horse equipment, while at first a saving, becomes an expense of considerable proportions eventually.

The company uses the carts principally for the haulage of bituminous coal, and very generally from the Summer street yard within a radius of two miles. The carts have a capacity of five tons and a mileage of 20 miles or better is made daily. The speed of the carts is approximately double that of horses, and it is practical to regard that each does the work of two two-horse carts, one man doing the work ordinarily done by two drivers. The work done by the machines is that for which horse carts would ordinarily be used, and there are no special hauls made in which they might be the most economical. In fact, it would appear that the machine would, in view of the experiences of others with them, be most productive in hauls of from two to four miles, but this character of work has not been chosen.

So far the electrics have given a very good measure of satisfaction, aside from the use of horse cart bodies, wheels and axles, and when it is realized that the efficiency increases with experience and the practical knowledge of the machines it may be understood that even more satisfactory results can be expected. The company may be said to be experimenting on what may appear to be a large scale, and while the immediate purchase of others is not contemplated, endeavor is being made to determine exact operating costs. Because of the fact that the company did not have its own garage until less than a year ago, and a considerable time must elapse before its organization is systematized and obtaining dependable figures, no definite figures are available. There are other factors, which have been stated, that must also be considered.

One of the problems given careful attention is the care and maintenance of the batteries. Because of the character of work for which the machines are used, and the presence of more or less dust, considerable difficulty is experienced in keeping the batteries clean, but it is expected that this can be largely overcome by better housing them and preventing foreign matter entering the boxes. Not only this, with the greater experience better results from them in longevity and capacity are naturally anticipated. The company has given considerable attention to tires. The cost of tires is a considerable item of expense, and while but two are used on a vehicle, the desire is to minimize this cost so far as possible. Originally the machines were equipped with block tires on the traction wheels, and later band shoes were used, but now block tires are being placed on the wheels whenever renewals are necessary. The belief is that block tires are giving the better mileage and traction, and for this reason the change is being made. The mileage from each type of tire is not less than can be reasonably expected, but the block form appears to afford the larger.

Of course, the greater experience has been with the four-wheel driven machine, and there is no doubt of the work that can be done with this, and yet the conditions under which it is used will not yield figures as favorable as were a number in service. At the Southampton street station a Mack five-ton truck has been used about a year, also on an experimental basis, and this has been used for practically the same work as the four-wheel driven truck. Of course the radius of movement of this machine is comparatively large, but this is of no special advantage because the company does not care for business that requires extremely long hauls, as the cost of delivery is prohibitive. This machine has a very large reserve, but as a rule this is not utilized. Normally neither machine is used longer than the regular working hours.

As to figures that will make possible the actual comparison of operating costs, the head of the transportation department says frankly that it takes a long time to ascertain the data that will allow exact determination, and there are variables that can only be learned by careful observation and averaged, a process that requires time. As a whole, the company is very favorably impressed with the results that have been thus far obtained. It purposes to economize its delivery and when sufficient facts have been obtained so that a decision can be made with certainty, there is no question that it will adopt the equipment that is known will best serve. With the capital invested in delivery equipment a transition is a problem of large moment, and there is no intention of making a mistake.

VETERINARIES AND BLACKSMITHS.

KisselKar Man Estimates This Income in America at $60,262,000 a Year.

Frank J. Edwards of the Kissel Motor Car Company, Hartford, Wis., maker of KisselKar trucks, has given some interesting facts relative to the transportation problems which are rarely considered by prospective purchasers of motor trucks. According to the census takers of the United States, there are 6567 veterinary surgeons and 23,554 owners of blacksmith shops, and Mr. Edwards maintains that it is conservative to assume that these 30,131 people average a gross income of $2000 a year, or in the aggregate, $60,262,000, derived principally from treating ill and disabled horses, shoeing them and repairing wagons.

"So it will be seen," says Mr. Edwards, "that there is quite something to consider in horse maintenance besides the consumption of food. We seldom have much trouble in proving the superior reliability and efficiency of the motor truck over horses, and in a large majority of cases the economy argument would be just as convincing if business men would keep more accurate records of horse hauling costs. Feeding, stabling, grooming, drivers' wages—those are about all the items of horse maintenance and operation that are generally submitted by the prospective truck buyer who wants comparative figures."

HAULAGE OF BUILDING MATERIALS.

Motor Trucks Economical in Delivery of Crushed Stone by Large Companies in Boston's Suburbs, as Shown by Comparative Work with Animal Equipment.

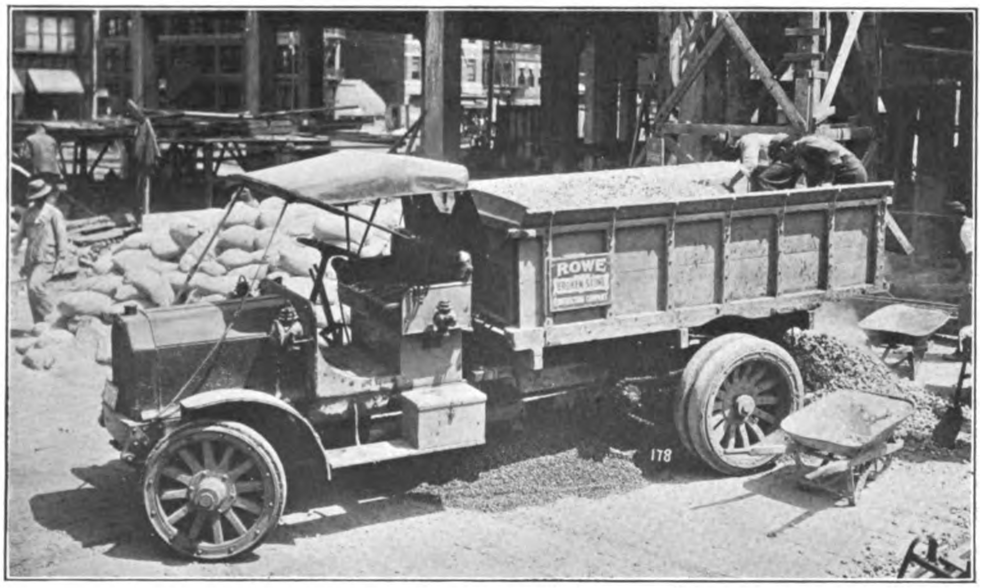
THE use of concrete for construction has become very general, one of the factors being the comparatively low cost, and another of equal importance is the fact that a structure of concrete may be made well nigh fireproof. This material is practical for every form of work and, when reinforced with metal, has remarkable strength. One of the three ingredients is crushed stone, which is superior to gravel from the fact that the rough surfaces insure unity with the cement, and a considerably larger proportion of stone can be used than when gravel is utilized.

There are certain qualities of stone that are desirable for crushing. While in cement a comparatively soft rock will perhaps serve satisfactorily, those who deal in crushed stone usually select a trap that will endure pulverizing influences, for this can be used for highway construction with excellent results, and it is equally serviceable for all other purposes.

In large cities where much construction is in progress the greater part of the year, and where street and road improvement is demanded, crushed stone is becoming more and more a necessity. In fact, it is quite as necessary as any other building material, and it is used in larger quantities each year. This demand has impelled the establishment of quarries and stone crushing plants as commercial necessities, and some of these are operated on a large scale. Stone may appear plentiful, but the desired quality is not always available, and when a satisfactory rock is found it is evident that the profit is proportionate to the production. That is, the larger the tonnage turned out the less the cost a ton. Some plants are so located that the stone may be shipped by railroad, but the majority of them are where the stone must be hauled by road vehicle.

While the demand may be large, it is apparent that transportation costs money, and each additional mile the cost increases, so that within a comparatively short distance the price will be so much increased that it will be prohibitive or will at least stimulate competition. That is to say, that were there a uniform price for crushed stone delivered at the crusher, and the expense of haulage added, the cost would be doubled with a haul of more than 7.5 miles, and, under some circumstances, in a lesser distance. In other words, the value of the stone is so small that it is unprofitable to haul it under the most favorable conditions, on good highways and without delays, for the prices that can be obtained.

It will be understood that where large quantities of stone are used, especially for highway purposes, municipal stone crushers are generally established, and in state work crushers are moved from time to time to meet the requirements of the work, the stone being hauled to them. These plants, however, do not always afford the quality of stone that is desired. It is not practical to make comparison of the cost of stone crushed under such circumstances, for the haulage must be added to the expense of production, a charge that is minimized or covered by handling with the quarry crusher.



Five-Ton Peerless Truck, One of a Fleet of Six Machines Used by the Rowe Construction Company at Its Crushers at Brighton.

Viewed by the highway contractor or builder the portable or movable crusher has advantages, but often the quality of the stone is inferior. If stone can be procured near it the price may be comparatively low, but to pay for haulage for material and for delivery rapidly increases the expense. The highway builder may have a roadside crusher and buy stone hauled by those who find the sale of rock an incentive to clear land, but it is hardly probable that it would be economy to establish a plant for crushing stone for structural purposes. In any event there would be the initial investment, and the haulage of stone would be so costly that it would be impossible to successfully compete with those who make the crushing of stone a business.

These statements have been made because the factors dealt with have important bearing on the sale of crushed stone. Summarized, it may be said that con-

Five-Ton White Truck, One of a Fleet of Three Machines Used by the New England Crushed Stone Company at Its Dorchester Quarry.

stone is delivered to the city of Boston for street construction, some is taken by contractors, and some is purchased for landscape work. The orders may vary from a few to many thousand tons and the hauls may be from a few hundred yards to six miles, and occasionally that distance may be exceeded to convenience a customer. This concern has a delivery equipment which includes 80 horses, about 40 carts and wagons, and six motor trucks, of which three are Packard three-ton machines, two are five-ton Alcos and one four-ton Peerless. The trucks and carts are equipped with quick discharging bodies, and at the plants all are loaded by gravity by chutes from the stone pockets. Thus it will be seen that, as practically all deliveries are made by dumping, there is no advantage obtaining in the trucks save in the greater capacity and the increased speed.

ditions that cannot be controlled limit the productive market to a radius of 7.5 miles from a plant, and this area cannot be extended save in the shipment of large tonnage by railroad or by tractor and trailer trains. It is practical, where the orders are of considerable size, to use tractors and trailers, for such equipment would be productive for about half the mileage, and the ton-mile expense of haulage would be proportionately reduced, but when the deliveries are of small quantities the trailers would not be practicable. In states where the size of the vehicle and the load are limited by law, as in Massachusetts, whether or not a tractor and trailers would be prohibited is a question not yet determined, but there is no certainty they could be used. Theoretically the laws specify vehicles of given weights and carrying definite loads, and there could seemingly be no application to trains of wagons or carts drawn by a tractor, each unit of which would be within the prescribed limits, but what might be decided by a legal or judicial mind is quite uncertain.

The Rowe Construction Company, which operates two stone-crushing plants in the Brighton district of Boston, and another in the city of Malden, is one of the largest enterprises of the kind in New England that does not ship stone by railroad. All of the production of 600 to 700 tons a day is delivered to customers within a radius of approximately six miles of the crusher, and this means that with a working year of about nine months, and approximately 230 business days, about 150,000 tons of stone are distributed.

A considerable part of this

The company purchased its trucks about the same time, taking delivery about the first of June, 1911, and it has operated them since then, a period of 26 months. Strangely enough, the company has, since it bought the machines, nearly trebled its horses, this being due to the increase in its business. That no more trucks were purchased was from the fact that the company desires to get accurate information relative to horse and motor truck cost, and has sought to do this by comparisons of the service records. The data must necessarily cover a considerable period and the machines must be given a thorough trial under all conditions of operation.

In making definite statement of results the com-

Five-Ton Mack Truck, One of Fleet of Three Machines in the Service of the West Roxbury Trap Company.

pany roughly makes comparison that the three-ton trucks are equal to two two-horse carts, and the four and five-ton trucks are equal to or better than four two-horse carts. But this may be qualified by the fact that the company does not generally use the machines for a lesser distance than three miles, and so they are ordinarily used for delivery in the longest hauls. The trucks are worked from the Brighton quarries, as at Malden the roads about the plant are exceedingly rough and the strain and stresses are unusually severe when the machines are driven upon them. In fact, the company believes that it is not economical to use them here in view of the possibilities of damage.

The trucks are driven an average of about 55 miles daily, and while it is not possible to average the tonnage because of the variance in the hauls, it is said by the company that the Peerless machine does nearly as much work as the five-ton trucks, for it is faster, and this is a factor of much importance in long hauls. The cost of operation may be best judged from the estimate of the value of the trucks when compared with horses, and a two-horse cart and driver may be hired for $6 a day, this being the prevailing price. If animal carts are profitable at this cost, then a truck that will cost $12 a day that will do the work of two such outfits is equally remunerative. And judging from the same basis a truck that will cost comparatively less and yet do the work of four carts or more, is a still better proposition. But with horses the company has found its haulage cost of stone to be about 13 cents a ton-mile. That is, to deliver a load of four tons three miles will cost with its own equipment $1.55, which is seemingly very low. On the basis of 13 cents a mile and an average of 55 miles a day for each machine, half the distance loaded to capacity, the five-ton trucks would earn $17.87, the four-ton trucks $14.30 and the three-ton trucks $10.72. There is this advantage with the trucks, however, that during the period of the year they are not used the cost is confined to interest on the investment and insurance.

The company has a garage at one of its yards, where the machines are stored, and this is in charge of a mechanic, who is required to give the trucks whatever attention is necessary and maintain them in operative condition. The overhauls and large repairs beyond the facilities of the garage are made at the service stations of the company. This concern has found the machines productive in that they are a decided economy in the manner they are worked, but were they used for short as well as long hauls, there would be better information available as to their productiveness in comparison with horse work of all kinds.

The New England Crushed Stone Company has its plant close to Franklin Park, in Jamaica Plain, and this is a quarry of trap rock and a crusher that has a capacity of several hundred tons daily. This company has a ready sale for its production, and it is to be compared with the Rowe Construction Company, so far as limitations for delivery through the cost of haulage. This company has three five-ton trucks in regular use, two Whites and one Mack, and these deliver the greater part of the rock crushed, there being a comparatively small part hauled by those who purchase it at the quarry. The company bought its trucks last season and has used them during the entire period the crusher was operated, the work being both short and long hauls. Prior to the use of trucks the company had horse equipment. The company is not inclined to make statements relative to the work that is accomplished with machines other than to state that they

Five-Ton White Truck Loading at the Stone Crusher of the West Roxbury Trap Rock Company, Boston, Mass.

are driven generally 50 and sometimes as much as 60 miles a day, and that they have given satisfactory service.

The company has a garage at the quarry in which the machines are kept, and this is in charge of a mechanic, who is responsible for the operation of the trucks. He is required to maintain them in a serviceable condition, and has the usual hand tools and equipment for making ordinary replacements and adjustments. In the event of extensive work the machines are sent to the service stations of the manufacturers.

The West Roxbury Trap Rock Company, which has a quarry and stone crusher near Walnut street, West Roxbury, not far from the Dedham line, is operated by Thomas F. Welch, a contractor, and besides supplying his own needs he has developed a considerable business in that section of Boston from Forest Hills to Dedham. The rock is delivered within a radius of about six miles, and as there is a great deal

of development and construction work in progress in that part of Boston, besides street and highway building, the plant is worked to its capacity practically all of the time. The stone was delivered by horses until about a year ago, when a White five-ton truck was purchased, and later a Mack and a Garford truck of the same capacity were bought. These machines are worked constantly and there is no idle time for them during the business part of the year. One of them is driven by the son of the owner, and his knowledge of driving and mechanics has been very serviceable, as he oversees the work of the other men and sees to it that the trucks receive the care and attention they should have. The machines are kept in a small garage at the quarry, and they are cared for by the drivers unless a repair of considerable importance, or requiring special facilities, is necessary. The mileage will run from 50 to 60 miles daily and the trucks are regarded as being at least equal to three two-horse teams and carts for stone delivery. The lack of records prevents a more definite statement or a very accurate idea of operating cost. There is no doubt, however, of the productive mileage driven daily, and the fact that the machines are practically all the time in service.

GOOD TIME FOR BUICK WAGON.

Covers 715 Miles Between San Francisco and Portland, Ore., in Practically 61 Hours.

A Buick delivery wagon of 1500 pounds capacity, has established a record between San Francisco, Cal., and Portland, Ore., that closely rivals that made by pleasure cars. The machine, which was manned by Claude McGee and Fred Gross of the Howard Automobile Company, San Francisco, Buick distributor, was loaded with exactly 1500 pounds of hardware, in addition to the baggage of the two men, and started for the northern city.

The actual elapsed time for the trip was 61 hours and five minutes. The distance is 715 miles and the time made comes within three hours of the pleasure car mark. In the report of the pilots it is stated that the entire run was made without the least mechanical difficulty and that the Goodyear tires used hardly showed a scratch as a result of the hard grind over the northern roads. Heavy grades were encountered in the Cascade and Sierra ranges.

RECORD BOSTON-NEW YORK TRIP.

Two Kelly Trucks Transport Furniture Over the Road on an Economical Basis.

Two one-ton Kelly trucks, made by the Kelly-Springfield Motor Truck Company, Springfield, O., and owned by Hersum & Co., Boston, Mass., recently made a record run from Boston to New York City and return. They carried two capacity loads of high grade furniture on the first half of the long run and delivered it in New York in perfect condition. The distance between the two cities is 242 miles, and the Kelly machines covered it in 22 hours and 50 minutes. The return trip was made without a load and took just 19 hours. The average speed loaded was 10.6 miles an hour, and returning, 12.7 miles.

The best record made was the economy in the consumption of gasoline and lubricating oil, both trucks using 90 gallons of gasoline, the average being 10.8 miles a gallon. Ten quarts of lubricating oil were used for the remarkable average of 96.8 miles a quart. The entire trip was made without an adjustment of any kind, and the two Kellys went through from start to finish without a hitch.

TO COMPETE WITH RAILROADS.

Motor Truck Club of Los Angeles to Operate Freight Line Over Special Highway.

An illustration of how firmly the mechanical transport has become established in this country is given in the action taken recently by the Motor Truck Club of Los Angeles, Cal. The club has announced that it will compete with the railroads running from that city to the harbor of San Pedro, about 20 miles distant, by operating a fleet of motor trucks over a specially constructed road. The members are going to back their belief in the economy and efficiency of the truck to the extent of over $350,000, which the road will cost.

The highway will be especially adapted to the use of heavy trucks, and every kind of merchandise will be transported from San Pedro, where it is laid down by ocean steamers, to the wholesale and retail districts of Los Angeles. The work is now being done by steam and electric railways, but there has long been general dissatisfaction against the slow, expensive service merchants have been getting. With commercial vehicles it is estimated that better service can be given at a minimum cost.

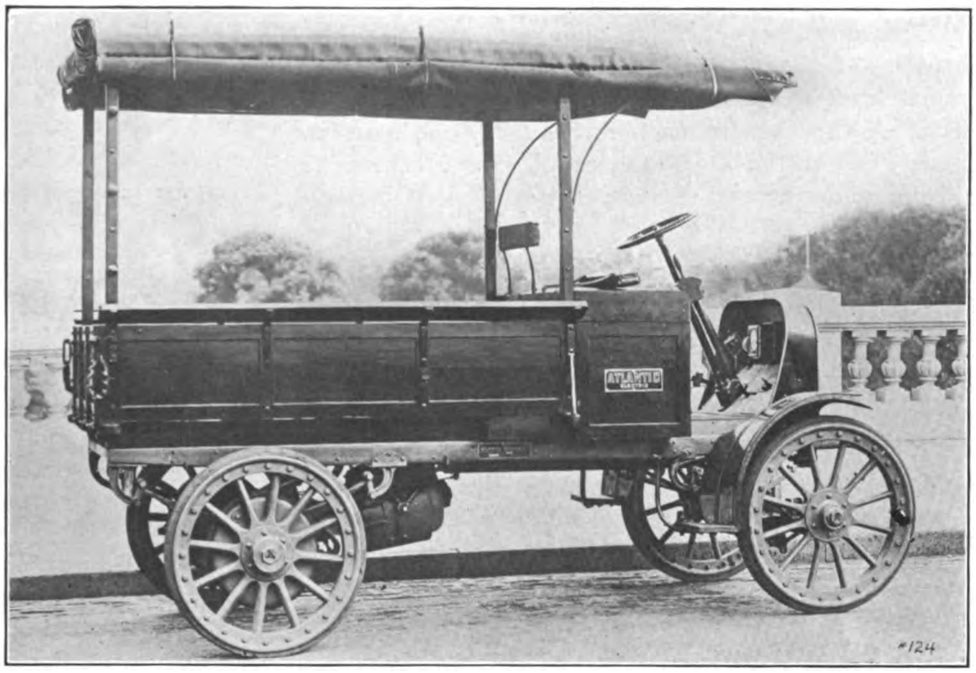
Detailed statistics of the carriage and wagon industry of the nation for the year of 1909, shortly to be issued by the census bureau of the Department of Commerce, show that there were in that year 5492 establishments that gave employment to an average of 82,944 persons, of whom 69,928 were wage earners, who were paid $45,555,126 in salaries and wages. The total cost of material used was $81,951,288 and the total value of the products was $159,892,547. The total capital invested was $175,473,728. The total number of vehicles manufactured was 1,519,782, as compared with 1,711,529 in 1904, this decrease being attributed to the manufacture of automobiles and motor trucks, and a considerable number of the concerns reported in censuses prior to 1909 as manufacturing wagons and carriages have since turned wholly or in part to the manufacture of automobiles and are now represented in the automobile classification. Ohio was the leading state in value of production.

NEW ATLANTIC 1000-POUND WAGON.

THE Atlantic Vehicle Company, with offices and salesrooms at 1600 Broadway, New York City, and factory at Newark, N. J., builder of the "long distance" Atlantic electric wagons and trucks, has begun the production of a 1000-pound wagon designed for general delivery purposes. The experimental and development work has extended over a considerable period, and the building of the machines commercially has been begun, the initial orders including an ambulance and a bank wagon for the Bethlehem Steel Company, Bethlehem, Penn., and an ambulance for the Didier-March Company, South Bethlehem, Penn.

The wagon is designed for the delivery of light loads at comparatively fast speed, the normal capacity permitting operation at 15 miles an hour, while it is maintained that it can be driven 65 miles on a single battery charge. It is unusual in that the motor is coupled directly to the rear axle housing, and the drive is through reduction gears to the full floating rear axle. The weight of the chassis is 2700 pounds. The chassis length is 140.5 inches and the wheelbase 102, and the machine can be turned in a radius of 25 feet, a very important factor in congested traffic or in narrow thoroughfares.

The chassis frame is heavily constructed of pressed steel, and it may be designed for either an underslung battery or a battery installed under the driver's seat. The accompanying illustration shows the last-mentioned type of chassis. Either type is produced at option of the purchaser.



The New Model Shaft-Driven 1000-Pound Atlantic Delivery Wagon, with Battery Under the Seat, Produced by the Atlantic Vehicle Company.

The motor is a standard production of the General Electric Company, 85 volts, 35 amperes, with maximum capacity at 800 revolutions a minute. The motor is enclosed in a water and dust tight steel frame, and as installed it is encircled with a heavy strap carrying trunnions at either side. These trunnions are mounted in stout brackets carried on two chassis frame cross members, so that the motor may be swung freely on them. Bolted to the motor frame at the pinion end is a cast steel housing, that encloses the short driving shaft, and two large pressed steel channels that serve as struts, the housing and the channels being in turn bolted to the rear axle housing. The rear axle is a full floating type, housed in a pressed steel shell, and this contains the differential gears and the driving shafts, the gear reduction being 5:1. Both the rear and the front axle are standard Timken productions, being of designs to have great endurance and fitted with Timken roller bearings for the wheel spindles and the steering pivots.

The chassis frame is mounted on semi-elliptic springs forward and rear, made from Krupp silico-manganese steel, the forward ends of the front springs being fixed in the spring horns, and the other ends being carried by large shackles. The spring hangers are steel castings, fitted with bronze bushings, and the springs are secured by self-lubricating bolts. This construction makes for long endurance and comparative ease of renewals of bushings when wear necessitates. The steering gear is a Ross construction of the irreversible type, with a hand wheel 16 inches diameter. The steering linkage is composed of steel forgings of ample size to insure satisfactory endurance. When the chassis is fitted with underslung battery the cradle is of substantial construction and the box is side loading, the doors closing tightly to afford the desired protection from dust and water. When the battery box forms the seat for the driver it is well covered and protected.

The wheels are of the regular artillery type, 12 spokes to a wheel, and are fitted with 34 or 36 by three-inch solid tires, these being the Goodrich demountable tires, made from a special compound that is intended to have high resiliency and long endurance. The brakes are both operated by pedals with direct linkage, one set internal expanding in and the other set external contracting on large steel drums attached to the rear wheels.

The controller is the General Electric Company's type S-103, form B, having four speeds forward and two reverse, the controller and the running and charging switch mounted as a single unit under the toe-

board. The controller is operated by a handle located conveniently under the steering wheel by a simple and positive linkage, and the lighting switch is also installed on the controller case on the steering column, where it can be easily reached. The running or main switch is a part of the control unit and it is operated by a removable key that projects through a slot in the toeboard, where it may be moved by the foot when desired. It is removable only in the neutral and charging positions. This may be used as an emergency switch in the event of need, such as the failure of the controller while the machine is moving. Then a kick will move the switch and cut off the current. The charging receptacle is dead at all times, save when the key is in a position for charging.

The dash is straight, with a short metal cowl for the protection of the indicating instruments and the lamps, and the regular equipment includes a Sangame ampere-hour motor, a Veeder hub cap odometer, two electric dash lamps, tail lamp, horn or bell, tail lamp and license bracket, charging plug and cable, and kit of tools. The body is optional with the purchaser, the normal loading space being 83 inches length and 40 inches width. As the machine has the same battery capacity as the 2000-pound wagon, its exceptional mileage under average operating conditions is understood.

FEDERAL AS STAGE COACH.

One Vehicle Replaces 32 Horses in Making Daily Trips Through Wyoming.

Many Federal motor trucks, made by the Federal Motor Truck Company, Detroit, are seeing service in the Far West, one of the latest being that sold to the Wamsutter-Slater Stage & Expressing Company in Wyoming. It is being used to cover a route hitherto travelled by stage coach and it passes through one of the most desolate sections of the country. To deliver the machine at Wamsutter it was driven from Denver, Col., and one stretch of 75 miles was encountered between Laramie and Medicine Bow, Wyoming, in which there was not a house, fence, post or telegraph pole.

The distance between Baggs and Wamsutter, the route over which the truck is used, is 50 miles. Formerly it required two changes of horses a day, or 24 horses for the round trip. The company also held eight horses in reserve for emergency use, so that the lone Federal has replaced 32 horses. The vehicle carries about 2700 pounds on its daily trip.

The Star-Tribune Motor Sales Company, Detroit, has placed in the market a delivery wagon with capacity of 1200 pounds. Small consumption of fuel is one of the qualities claimed for this machine, and it is maintained that an average of 24 miles to the gallon can be made on ordinary roads.

MARTIN TRACTOR COMPANY.

Organization with Capital of $300,000 to Manufacture Under Martin Patents.

The Martin Tractor Company has been organized at Springfield, Mass., with capital of $350,000, and it is purposed to begin the manufacture of tractors commercially under the patents issued to Charles H. Martin, to which it has exclusive right, save for the Knox Automobile Company, with the privilege of licensing the building of the machines by other manufacturers. Up to the present time the Martin tractors have been produced only by the Knox company. The demand for these machines has so greatly increased, and the prospect is so promising, that the company has been formed for production in such numbers as will meet the requirements of the market.

The officers of the company are: President, Harry G. Fisk; vice president and general manager, Charles H. Martin; treasurer, E. O. Sutton; secretary, C. E. Beckwith. One of the largest stockholders of the company is S. S. Eveland of Philadelphia, Penn.

NEW BOSCH BRANCH IN NEW YORK.

Field of Operations Will Include Eastern States and Afford Better Service.

The Bosch Magneto Company has relieved the executive officers and the staff of the New York office of the service work under their supervision by the organization of a separate department that will be known as the New York City branch, and which will operate in the eastern territory, which will include all the states east of the Ohio and the Mississippi rivers. The purpose is to give undivided attention to users of Bosch magnetos in that section of the country. The branch is located in the Bosch building, 223 West 46th street, New York, where it will remain until its growth or the demands of the other departments shall necessitate removal. The branch is in charge of Alfred J. Poole, formerly assistant chief engineer, who has an adequate corps of assistants.

A line of motor 'buses has been opened by W. W. Thompson to be operated over the old Albany post road between Tarrytown and Hastings, N. Y. The installation at present consists of two 40 horsepower Kelly-Springfield motor chassis, on which are mounted two 30-passenger, side entrance 'bus bodies. The machines leave Tarrytown hourly and arrive at Hastings 40 minutes later, passing through Irvington, Sleepy Hollow and Dobbs Ferry. Standard trolley car seats of two-passenger cross type with centre aisle are arranged, all facing forward. Electric push buttons are installed to signal when one desires to leave the vehicles, and clusters of electric lights in the centre of the roof light the vehicles at night.

CASE TRACTORS WIN IN WINNIPEG.

WHILE there were more classes in the sixth annual agricultural motor trials, held in conjunction with the Canadian Industrial Exhibition in Winnipeg, Manitoba, Canada, in July this year, than was true in 1912, and consequently a greater number of prize winners, an analysis of the official score sheets for the two years indicates somewhat less interest on the part of manufacturers. This year there were 10 classes, in which 19 machines of three different makes competed. Last year there were seven classes and 25 machines, representing 10 different makes. At the other hand there were two classes last year in which there was but one entrant each, while this year there was but one.

The Sawyer-Massey Steam Tractor and Trailer, Only Canadian Make to Compete in Trials.

The first prize winners were as follows: Division 1, class A, gasoline tractors with piston displacement of 300 cubic inches a minute or less, Case; class B, gasoline tractors with piston displacement of 300-500 cubic inches a minute, Case; class C, gasoline tractors with piston displacement of over 500 cubic inches a minute, Sawyer-Massey. Division 2, class A, kerosene tractors with piston displacement of 300 cubic inches a minute or less, Avery (no competition); class B, kerosene tractors with piston displacement of 300-500 cubic inches a minute, Case; class C, kerosene tractors with piston displacement of over 500 cubic inches a minute, Case. Division 3, class A, steam tractors with piston area in square feet times 200 times .8 equalling 60 or less, Case; class B, steam tractors with piston area, etc., equalling 60-100, Case; class C, steam tractors with piston area, etc., equalling over 100, Case.

A comparison of the general averages for the trials of 1911, 1912 and 1913 undoubtedly will prove of interest. It should be borne in mind that the price of gasoline has changed very materially during the past year, and in computing this year's results gasoline was figured at 27 cents a gallon of seven pounds, as compared with 19.5 cents in 1912. The price for 1911 was half a cent less than in 1912—hardly enough to affect the final result very materially, but worthy of being kept in mind during the consideration of these comparisons.

There was no class A for gasoline machines in 1912. This year, the score sheet shows an average fuel cost a brake horsepower of 2.81 cents in this class. Reducing this to the same price as in 1912, as a further basis of comparison, the result is 2.067. In class B, the average for 1911 was 1.648 cents, and for 1912, 1.787 cents. This year the average was 2.28 cents, or when reduced to 19.5 cents a gallon, 1.647. The average for class C in 1911 was 1.944 cents, and in 1912, 1.961. This year the average in this class was 2.87 on the face of the returns, or 2.072, when reduced to the same cost figures as last year. The average for all kerosene machines was: In 1911, 1.274 cents; 1912, 1.603; 1913, 1.625.

Of course, the averages based upon the cost of gasoline at 19.5 cents a gallon have no value this year in arriving at the relative economy of gasoline and kerosene machines. These figures only serve as a basis of comparison as to general efficiency and economy between this year's models and those of 1911 and 1912. The best score in this respect this year was made by the Case winner in the gasoline class B, this being 2.26 cents on the basis of 27 cents a gallon for

A Corner of the Exhibition Grounds at Winnipeg Industrial Exposition, Showing Some of the Machines Which Did Not Compete in the Trials.

A Gasoline Member of the Winning Case Team, Engaged in Plowing Test.

fuel, or 1.632 on the basis of 19.5 cents a gallon. The average for all gasoline machines in 1912 was 1.834, and the best score, 1.509, made by a Canadian Aultman & Taylor.

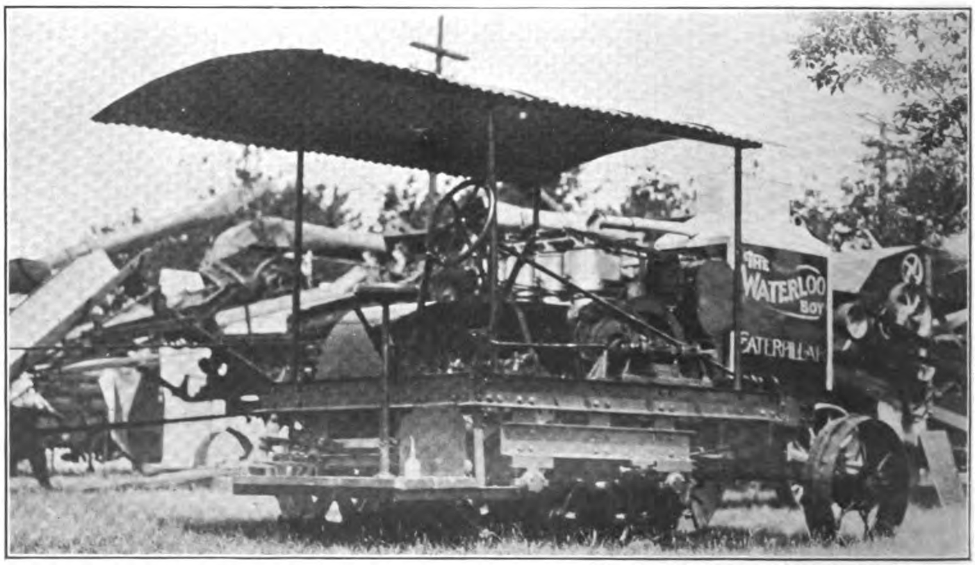
The relative economy of gasoline and kerosene machines was in favor of the latter both years. The best kerosene score in 1912 was 1.295 for a Rumely Oil-Pull, while the best showing this year was 1.41, made by a Case. The comparative figures for 1912 were, therefore, 1.509 for gasoline, as against 1.295 for kerosene (best scores), and for 1913, 2.26 for gasoline as against 1.41 for kerosene. The averages show 1.603 for kerosene machines in 1912 as against 1.834 for gasoline tractors, and for 1913, 1.625 for kerosene as against 2.71 for gasoline. It should be remembered that the price of kerosene was the same both years, 14.5 cents for a gallon of 7.9 pounds. In this consideration of the proposition gasoline is rated 27 cents a gallon this year, of course.

Coming now to the question of plowing, the figures given being the cost of fuel an acre plowed: In the gasoline class A, the average was 63.5 cents, or 45.8 cents when computed on the basis of 19.5 cents a gallon. There was no class A in 1912. In class B, the average for 1913 was 69.75 cents (50.37 at 19.5 cents a gallon), as against 54.03 for 1912. In class C the figures are 57.6 (41.6) in 1913, 49.15 in 1912 and 47.28 in 1911. These show a better relative economy between the models for the three years, when compared on the same basis of fuel cost. Insofar as class C is concerned, there appears to have been a decided improvement over 1911, there having been a loss of efficiency in this respect in 1912 over the previous year.

In the kerosene classes, the figures for 1913 show an average cost an acre plowed of 53.4 cents, 53.2 and 47.35, in classes A, B and C, respectively. There were no corresponding classes in 1911 or 1912. However, in 1912 the figures were: Class D, 52.6 cents, and class E, 45.1. The averages for all kerosene machines in the three years were: In 1911, 37.17 cents; 1912, 48.36; 1913, 50.9. The average for all gasoline machines in 1912 was 49.56 cents, and in 1913, 62.11.

The individual scores on the more important points, and the finals, are presented in the following table:

No.	Make.	H. P.	Cost B. H. P. Cents.	Cost Acre Cents.	Final Score.
	Division 1, Class A, Gasoline.				
1	Case	15	2.97	69.6	325.60
19	Avery	12	2.66	57.4	238.95
	Division 1, Class B, Gasoline.				
3	Case	20	2.26	57.6	352.00
2	Avery	20	2.30	81.9	316.75
	Division 1, Class C, Gasoline.				
4	Sawyer-Massey	25	2.66	56.6	359.05
5	Case	40	2.30	59.9	355.55
7	Avery	30	3.71	46.5	290.05
6	Case	40	2.81	67.4	154.05
	Division 2, Class A, Kerosene.				
8	Avery	12	1.90	53.4	193.10
	Division 2, Class B, Kerosene.				
10	Case	20	1.41	45.8	338.10
9	Avery	20	1.78	60.6	238.25
	Division 2, Class C, Kerosene.				
12	Case	30	1.56	50.9	331.05
11	Case	40	1.46	43.8	306.15
	Division 3, Class A, Steam.				
14	Case	..	1.37	43.6	383.85
13	Sawyer-Massey	27	1.44	42.8	382.50
	Division 3, Class B, Steam.				
15	Case	..	1.31	37.4	406.70
16	Sawyer-Massey	25	1.67	55.9	322.55
	Division 3, Class C, Steam.				
17	Case	..	1.06	37.0	437.30
18	Sawyer-Massey	35	1.67	49.5	349.80



Another View of the Exhibition Grounds, with the Caterpillar Tractor in the Foreground.

BRIEF NEWS OF MANUFACTURER AND THE TRADE

The A. O. Smith Company, Milwaukee, Wis., maker of Smith-Milwaukee trucks, announces that because of the necessity for additional space for its frames and other pressed steel parts, the manufacture of the Smith multiple disc clutch will be transferred to the Universal Machinery Company, Milwaukee, which will hereafter make the clutch under the supervision of the Smith company.

The E. V. Stratton Company, Albany, N. Y., which has done a splendid business in Hudson cars and Stewart trucks, has had its territory extended to include all of New York State west to and including Montgomery and Franklin counties, and south to part of Ulster and Duchess; five counties in Vermont and three in Massachusetts, including the city of Springfield. John S. Harrington, formerly of Worcester and Boston, has been secured by the Stratton company to handle Hudson cars and Stewart trucks in the Springfield district.

The Alma Motor Truck Company, maker of Alma trucks, has established its general sales office at 870 Woodward avenue, Detroit, with W. M. Hogle, general sales manager, in charge. The factories, as in the past, are located at Alma, Mich.

The Brodesser Manufacturing Company, Milwaukee, Wis., which has been making a delivery truck for the past two years, has been incorporated for $20,000 by P. H. Brodesser, Roman Brodessor and Harry Soulen. The new capital is to be used to enlarge the business.

The Brown Commercial Car Company, Peru, Ind., was the only exclusive truck manufacturer represented in the recent Indiana-Pacific tour of the Indiana Automobile Manufacturers' Association. The excellent performance of this internal gear-driven machine, carrying a supply of tires for the pleasure vehicles in the party, was such as to excite favorable comment throughout the journey. When it is remembered that the route selected included some of the worst roads in the country, as well as several mountain passes with exceptionally high altitudes, it readily will be seen that the test to which the truck was subjected was entirely out of the ordinary. The accompanying illustration shows the crew on the road near Jonesburg, Mo.

F. C. Brown, formerly branch manager at Albany, N. Y., for the Diamond Rubber Company, Akron, O., maker of Diamond tires, has been appointed New England district manager for the Chase Motor Truck Company, Syracuse, N. Y., maker of Chase air-cooled trucks, with headquarters in Boston.

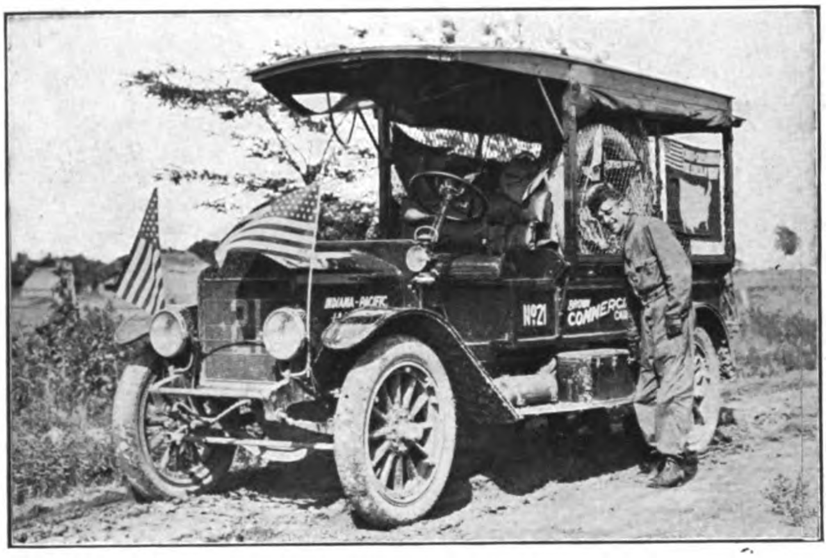
The property of the General Fire Extinguisher Company, in West Exchange, Bradford and Cedar streets, Providence, R. I., vacated by that company for a larger plant at South Auburn, R. I., is suited for manufacturing purposes, or it may be made a mammoth garage for motor trucks for comparatively trifling expense. The buildings are five in number, four of them directly connected, and the fifth connected by overhead passages, having a floor area of approximately 78,000 square feet. Buildings Nos. 1 and 3 are of brick, with three stories and high basements, and the other three structures are of brick and frame, or brick and stone construction. The buildings are piped for steam heat and for the Grinnell sprinkler system, the latter insuring minimum insurance rates. The location is convenient to the business section of Providence and is ideal for a garage and service station. The property, which has a total area of 84,644.46 square feet, can be purchased as a unit, or it may be divided into nine parts for the purpose of sale, the five buildings and four parts of unoccupied land. Full information may be obtained from G. L. & H. J. Gross, managers of estates, 170 Westminster street, Providence, R. I.

President Thomas L. Robinson of the Republic Rubber Company, Youngstown, O., maker of Republic tires, recently had as his guests at the Youngstown Country Club, branch managers, officials and department heads to the number of about 40. Dinner was served, after which speeches of a business nature were given. The list of guests included H. K. Wick, John C. Wick, Youngstown; M. E. Murray, San Francisco; C. W. Hardin, New York City; J. W. Maguire, Chicago; B. C. Swinehart, Philadelphia; B. F. Morris, Buffalo; W. S. Carleton, Boston; J. C. Kearns, Detroit; W. R. Goudie, F. G. Hill, H. W. Pratt, New York City; G. A. Sohl, Atlanta; J. Palmer, Chicago; F. W. Osmun, Minneapolis; G. M. Hoffman, St. Louis; G. N. Talcott, Cleveland; T. L. Robinson, president, Republic Rubber Company; L. T. Peterson, first vice president; J. H. Kelly, second vice president and general sales manager; A. H. Harris, superintendent; W. D. Morris, assistant general superintendent; C. F. Garrison, secretary; M. I. Arms, 2nd, treasurer; H. W. Bixler, assistant sales manager; Web Brown, advertising manager; N. W. Sayles, purchasing agent; G. L. Stansbury, auditor; O. M. Norby, manager, credit department; E. B. Frase, manager, hose department; Thomas Matchett, manager, belting department; T. J. Mell, inventor, Staggard tread; W. D. Norris, shipping clerk; C. A. Rice, M. E., E. E.; W. Dunn, paymaster.

H. S. Firestone, president of the Firestone Tire & Rubber Company, Akron, O., maker of Firestone tires, is touring abroad with his family. The party is motoring through France, Italy, Germany and Switzerland, and expects to return to Akron about Sept. 1.

Norman H. Halliday has been appointed by the International Motor Company, New York City, maker of Mack, Saurer and Hewitt trucks, as manager of its New England branch at Boston. Mr. Halliday is well known to the New England trade through his former connections with the Packard and Thomas companies.

H. C. Whitney, for several years general southern representative of the American Locomotive Company, New York City, maker of Alco trucks, and more recently connected with the Atlanta branch of the Locomobile Company of America, Bridgeport, Conn., maker of Locomobile trucks and pleasure cars, has taken the position of southern district manager of the Lozier Motor Company, Detroit, maker of Lozier cars.



The Brown 3000-Pound Internal Gear-Driven Wagon That Carried the Tires for the Competitors in the Indiana-Pacific Tour.

W. D. Clisbe of Detroit and J. W. Lucas of Benton Harbor, Mich., have secured the patents, patent drawings and trucks of a motor truck concern organized some time ago at Benton Harbor. It is planned to eventually employ between 2000 and 4000 men.

The Church Motor Car Company, Chicago, has been incorporated for $1,000,000 by A. G. Lattner, W. J. Maloney and N. P. Coffin. The company will build pleasure cars and trucks employing the Church automatic motor. Efforts are being made to secure a factory in Detroit and the permanent plant will be located in that city.

The Peerless Motor Car Company of New York, factory branch of the Peerless Motor Car Company, Cleveland, O., maker of Peerless trucks and pleasure cars, has appointed Fred H. Cozzens manager of the motor truck department.

The White Company, Cleveland, O., maker of White pleasure and commercial vehicles, recently opened a new salesroom and service station at 216-218 North Broad street, Philadelphia. As is true of all the branch houses of the White company, provision is made to take care of every need of White users in the entire district served by Philadelphia.

The Lauth-Juergens Motor Car Company, Fremont, O., maker of Lauth-Juergens trucks, has elected the following directors: J. Lauth and P. Lauth of Chicago; L. C. Worst, J. W. Worst, J. W. Forsyth, W. A. Lucas, L. W. Overmeyer and A. E. Culbert.

Thomas J. Holland, designer and patentee of a new style of flexible wheel for motor cars and trucks, has organized a company at Antigo, Wis., to manufacture and market the wheel. The corporate name of the concern is Holland Flexible Auto Wheel Company, and the capital stock is $10,000. Associated with Mr. Holland are James L. Donahue and John E. McKenna.

Henry O. Stenzel, president of the Milwaukee Tire & Supply Company, 457-459 Milwaukee street, Milwaukee, Wis., has organized the White Automobile Company to take the district agency for White cars and trucks, made by the White Company, Cleveland, O. Temporary quarters are in the Tire & Supply building on Milwaukee street and a garage and salesroom will be leased or erected this year.

W. J. Carter, late of the Oldsmobile St. Louis branch, is vice president of the Velie Motor Company of Missouri, St. Louis, Mo., incorporated recently to handle the Velie motor cars and trucks. Other officers are: President, J. A. Level; treasurer, J. R. Level; secretary, C. F. Swartz. Plans are being drawn for a three-story fireproof concrete salesroom and garage at Lake and Delmar avenues.

The Kissel Motor Car Company, Hartford, Wis., announces the following agents for KisselKar trucks and pleasure vehicles: J. T. Gentry, San Bernardino, Cal.; Blenn A. Calkins, Riverside, Cal.; Fred Duville, Pomona, Cal.; George Gilmore, El Centro, Cal.; Joseph S. Peoples, Petaluma, Cal.; Benjamin L. Brundage, Bakersfield, Cal.; P. J. Weisel & Co., Anaheim, Cal.; J. C. Phelan, Fresno, Cal.; Pacific KisselKar branch, Oakland, Cal.; West End garage, Santa Ana, Cal.; E. B. Jones, Hornell, N. Y.; Empire garage, Middletown, N. Y.; Flato & Allen, Kingsville, Tex.; Oliver-Nussbaum-Scharf Company, Grosbeck, Tex.; W. S. Mattox, Greenville, Tex.; Lyscio & Walker, Joplin, Mo.; Nemic & Biscenius, St. Cloud, Minn.; J. W. Bush, Oakes, N. D.; New Island City garage, Galveston, Tex.; Reno Nevada Company, Reno, Nev.; William Daly, Paterson, N. J.; Thomas Plimley, Victoria, B. C.; Kentucky KisselKar Sales Company, Lexington, Ky.; Waterloo KisselKar Company, Waterloo, Ia.; Douglass Motor Car Company, Douglass, Ariz.

The New Factory of the Electric Auto-Light Company at Toledo, O., Which Has Greatly Increased the Production of That Concern.

The Lewis Electric Welding & Manufacturing Company, West Toledo, O., is to build a new gray iron foundry to supply castings used in the construction of motor parts made by the concern.

The Transit Motor Truck Company is the new name of the Transit Motor Car Company, Louisville, Ky., maker of Transit trucks.

The Dayton Chainless Trucks, formerly made at Dayton, O., by A. E. Ausman, are to be built at Chattanooga, Tenn., according to a report recently issued. The vehicles will be known under the name Chattanooga.

The Huselton Motor Company, Butler, Penn., is a new truck concern which has begun the manufacture of vehicles of 1500 pounds capacity.

H. C. Mayo, one of the most popular salesmen in Boston, and for many years associated with the Peerless branch of that city, has joined the sales organization of the J. W. Maguire Company, agent for Pierce-Arrow pleasure vehicles and trucks. Mr. Mayo will travel through New Hampshire and Vermont.

Herbert P. Choate has become sales manager of the Star Motor Car Company, Ann Arbor, Mich., maker of Star trucks. He was formerly connected with the Empire Tire Company, Trenton, N. J. He has made arrangements with George C. Hupp and J. E. Hannon, the latter formerly secretary of the Michigan state fair, to act as Michigan distributor for the Star trucks. They have formed the Star-Tribune Motor Sales Company with headquarters at 815 Woodward avenue, Detroit, where Mr. Choate will be located. Mr. Hupp announces that he is still connected with the R-C-H Corporation, having resigned as an officer to become connected with the manufacture of the Tribune car, a new machine on the market.

Chanslor & Lyon, Los Angeles, Cal., distributor of Stromberg carburetors, made by the Stromberg Motor Devices Company, Chicago, has recently established a series of service stations throughout the Pacific Coast district for the accommodation of Stromberg users.

Harvey M. Briggs has succeeded Otto R. Bieler as chief engineer of the Lord Baltimore Motor Car Company, Baltimore, Md., maker of Lord Baltimore trucks.

H. S. Dunlevy has succeded L. C. Long as sales manager of the Chicago branch of the Federal Motor Truck Company, Detroit, maker of Federal trucks.

The Wood-Van de Verg Auto Company, 432-434 West Pico street, Los Angeles, Cal., has taken the agency for Krebs trucks, made by the Krebs Commercial Car Company, Clyde, O.

The Reliance Automobile Company, San Francisco, Cal., has taken the agency for Dart commercial vehicles, made by the Dart Manufacturing Company, Waterloo, Ia.

The Whitney Bros. Company, Santa Cruz, Cal., has taken the agency for Velie and Alco trucks.

The Stewart Motor Corporation, Buffalo, N. Y., has appointed the following distributors of Stewart delivery wagons: Charles L. Papworth, Lockport, N. Y.; Seacoast Garage Company, Asbury Park, N. J.; Edgewood Garage, Providence, R. I.; Van's Garage, Kingston, N. Y.; William Petry Garage, Hudson, N. Y.; Payne Automobile Company, Troy, N. Y.

The Electric Auto-Light Company, Toledo, O., maker of starting, lighting and ignition systems, has by the erection of the building shown by the accompanying illustration, increased the floor space of its plant more than 25,000 square feet. More than 100 additional workmen have been employed. The building has been equipped with high-grade automatic machinery. The company now has a capacity of 100 complete systems a day, but it is believed that it will be necessary to still further increase the production departments before the end of the year.

Fred A. Law, until recently superintendent of the Selden Motor Vehicle Company, Rochester, N. Y., maker of Selden trucks, has returned to Boston, where he is conducting a general supply agency. He was formerly identified with the Electric Vehicle Company, later the Columbia Motor Car Company, Hartford, Conn., having designed the first four-cylinder gasoline motor ever made by it.

E. George Walker, formerly connected with the sales forces of the Oldsmobile and Garford companies, has joined the Hartford Auto Parts Company, Hartford, Conn., as sales manager and service engineer.

Salt Lake Automobile Company, Salt Lake City, Utah, has established a truck service department in charge of a truck expert.

R. W. Kerns, formerly general superintendent of the Brecht-Butcher Supply Company, St. Louis, Mo., has joined the sales force of the Missouri Motor Car Company, and is now in charge of the truck department.

R. E. Frye, who has been identified with the Williams-Frye Sash & Door Company, St. Louis, Mo., where he is well known in business circles, is now general manager and an officer in the Lindsey Motor Car Company of that city.

The Holtzer-Cabot Electric Company, Brookline, Mass., is issuing a new booklet on Reacto horns, which the company manufactures.

The Adams Bros. Company, Findlay, O., manufacturer of Adams trucks, at its recent annual meeting elected the following officers for the coming year: President, Joseph W. Kwis; vice president, C. H. Bigelow; secretary, L. J. Adams; treasurer, B. B. Bigelow; general manager, W. D. McCaughey; purchasing agent, D. B. Adams.

W. S. Bashaw, owner of the Detroit Electric Car Company, has opened business at 108 Brady street, Davenport, Ia., and will handle the Detroit electric line, made by the Anderson Electric Car Company, Detroit.

The Auto Drive & Parts Company, Indianapolis, Ind., has been incorporated with a capital of $100,000. It will establish a factory at Indianapolis to manufacture drives and differentials invented by W. H. Harris.

The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., SEPTEMBER, 1913 No. 9

NATIONAL TESTS OF FIRE APPARATUS.

Gasoline Pumping Engine Trials, Under Exacting Conditions of Underwriters, Demonstrate Endurance and Capacity in Connection with International Convention of Chiefs' Association and Exhibition of Improved Equipment.

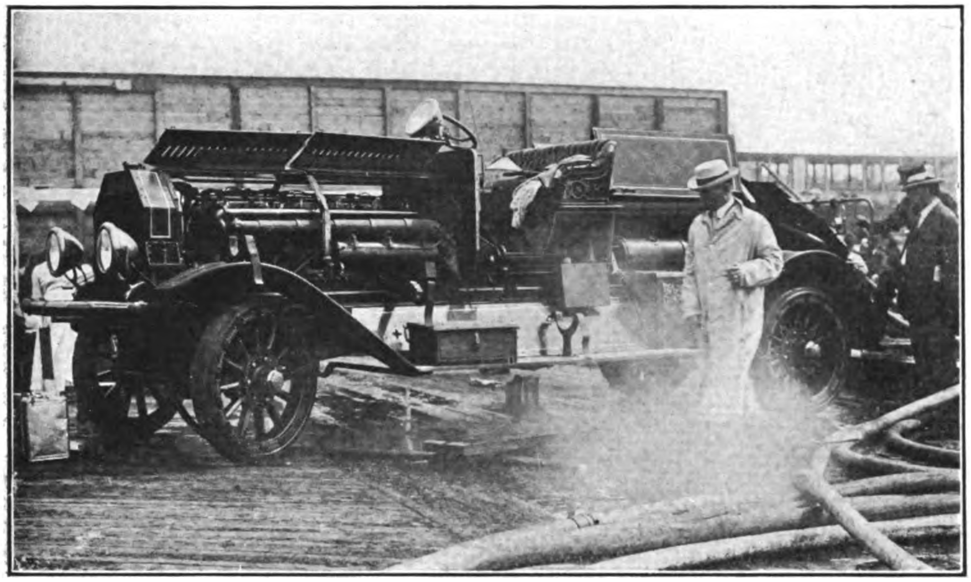
THE 41st annual convention of the International Association of Fire Engineers, held in New York City, Sept. 1-6, inclusive, was given over very largely to the consideration of motor propelled and motor pumping department equipment and maintenance, and in connection with the convention was an exhibition of motor apparatus by the makers, and a series of apparatus tests conducted under the direction of the National Board of Fire Underwriters. There were many other features in which the fire engineers were greatly interested, but these were foreign to the papers, the exhibition and the trials, and will not be considered in this article. Included in the exhibition were numerous displays of equipment for fire departments, accessories for departmental apparatus, differing forms of fire protection, protective and life-saving devices, and parts that are designed purposely for fire apparatus construction.

Observers Taking the Reading of the Nozzle Pressure, a Record That Was Made Every Five Minutes, and from Which the Actual Work Was Computed.

The convention was attended by more than 1200 chief engineers of fire departments from all parts of the United States, from Europe and from Egypt, and many thousands of firemen, municipal and fire department committees, and while those who attended the convention proceedings were comparatively few in number, it is true that the exhibition was visited by a very large number, while the trials were witnessed by practically all the chief engineers and committees. In connection with the exhibit numerous street and pumping demonstrations were made by the representatives of apparatus builders.

The convention has taken place three times in New York in the history of the association and during the meeting the visitors were entertained in a manner that was typical of New York, only more so than ever before. The weather was favorable, but the temperature was exceedingly high for four days, and then the visitors were privileged to witness one of the most severe electrical storms ever known in New York. The last two days of the sojourn in New York the temperature was lower and rain fell intermittently.

Father Knickerbocker has never been known to stint at entertainment, and the fire fighters were royally welcomed and their stay made memorable in many ways, for besides the convention, the exhibition and the trials, there were dinners, banquets, visitations to Coney Island and its attractions, while there were innumerable pleasures that were incidental to the formalities. In many of the places of amusement the engineers were given entre during their stay. Open house was kept by the New York firemen. Mayor



Chief John Kenlon Observing the 1000-Gallon Seagrave Pump Amid a Shower of Spray from a Leaky Coupling—This Machine Worked the Full 12 Hours of the Trial.

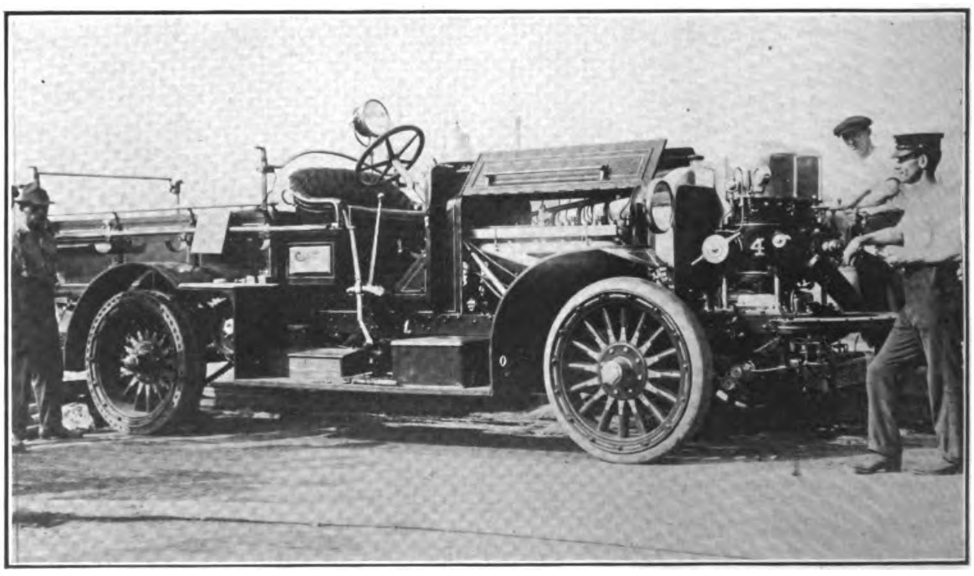
William J. Gaynor, Fire Commissioner Johnson, Chief John Kenlon and their subordinates, to say nothing of the 4500 men of the department, constituted an entertainment committee, and the municipal protective organization contributed an exhibition by the fire boats at the Battery, a boxing match by two skilled amateurs (both active firemen), and there was a battle to a finish between ball teams representing the police and fire departments. One of the features of the week was the unveiling of the Firemen's Memorial Monument at Riverside Drive and 100th street, in connection with which was a parade in which the New York department, all the visiting firemen, and numerous fire companies from New York and New Jersey were participants. The volunteer fire companies with their "parade" apparatus, were a distinct attraction, and in the line was seen everything from the antiquated hand pump to the latest constructions and many of the machines on exhibition. The finale was a banquet at the Hotel Astor the evening of Saturday, Sept. 6.

Such in brief outlines the events that continued through the six days and which will no doubt be memorable in the minds of all who were concerned in or had their attention directed toward the activities and pleasures of the occasion. Every minute of the time was taken up with convention duties, sightseeing and amusement, and the firemen certainly had strenuous lives for several days. But one day was devoted to honoring the dead of the New York fire department, there being a magnificent memorial dedicated by representative citizens with the assistance of the visitors and innumerable thousands of New Yorkers.

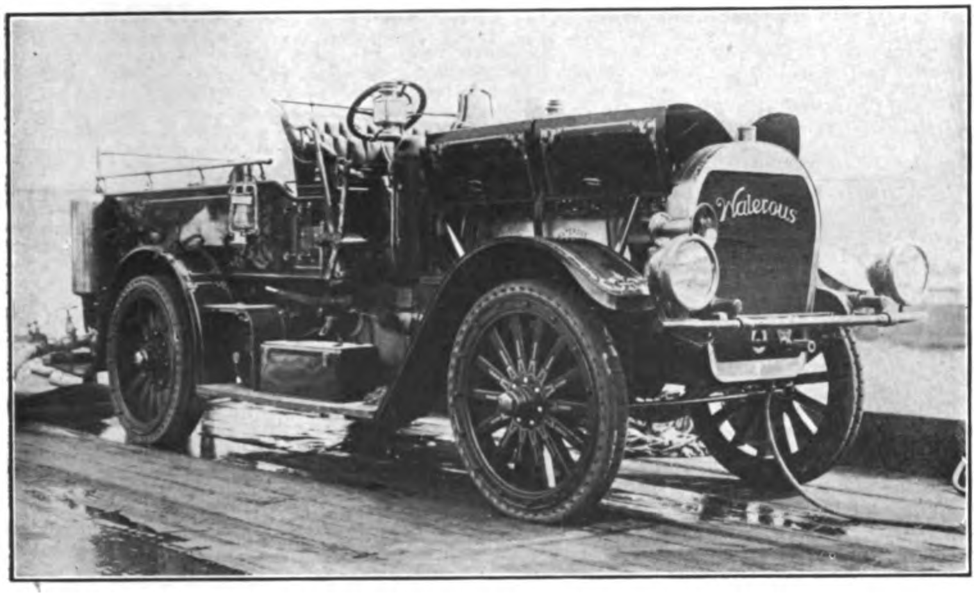
The convention itself was a notable gathering, there being in attendance men from all parts of the United States and Canada, while Chief M. J. Meier of the Amsterdam, Holland, fire department; Arthur Reginald Dyer, divisional officer of the London, England, fire brigade, and Major E. C. Walker, superintendent of the Alexandria, Egypt, fire brigade, were three of the notable engineers at the sessions. Chief Meier is president of the International Fire Service Council and is very well known and prominent in Europe.

So far as the sessions of the convention were concerned they were especially interesting to those having interest in motor propelled and motor operated apparatus. In all seven subjects were considered, and of these three dealt wholly with motorized equipment and its use. Two of these were papers read at the first session of the convention, and one was presented by Arthur R. Dyer, who described the London fire brigade's apparatus and the development of it from the hand or horse types to the motor vans, pumps and ladders. The third was an analysis of maintenance requirements for motor apparatus and was prepared with a very thorough knowledge of conditions by the head of the repair division of the New York fire department.

If there is any criticism of the convention it should be in the fact that the fire chiefs did not discuss the papers to the length that would appear desirable, for the discussions were written after careful study and observation and the conclusions were reached after mature deliberation and reflection.



Ahrens-Fox 700-Gallon Six-Cylinder Pump That Went Through the Three Successive Pumping Periods with a Perfect Score, Exceeding at All Times Its Rating.



Waterous Six-Cylinder 700-Gallon Pump That Worked Continuously 12 Hours with a Pumpage That Was Very Close to Its Rated Capacity.

There was one thing evident—that there was no interest whatever in horse apparatus. The heads of the city organizations had probably expressed themselves so definitely that there was not in the exhibition a horse equipment, unless it were a converted ladder truck that was originally intended to be drawn by hand and had been modernized by the substitution of a tractor for the original tongue. This could be used with horses, but these only when the runs were long.

The convention delegates without exception thought and talked motor apparatus. All of the spare time of the engineers was given over to the examination of the equipment displayed, but because of street demonstrations and the trials, official and to committees, some of the machines were absent from the Grand Central Palace a considerable part of the time. So far as the public was concerned there was incidental interest, and there was abundant opportunity for those who cared to do so to examine the exhibits.

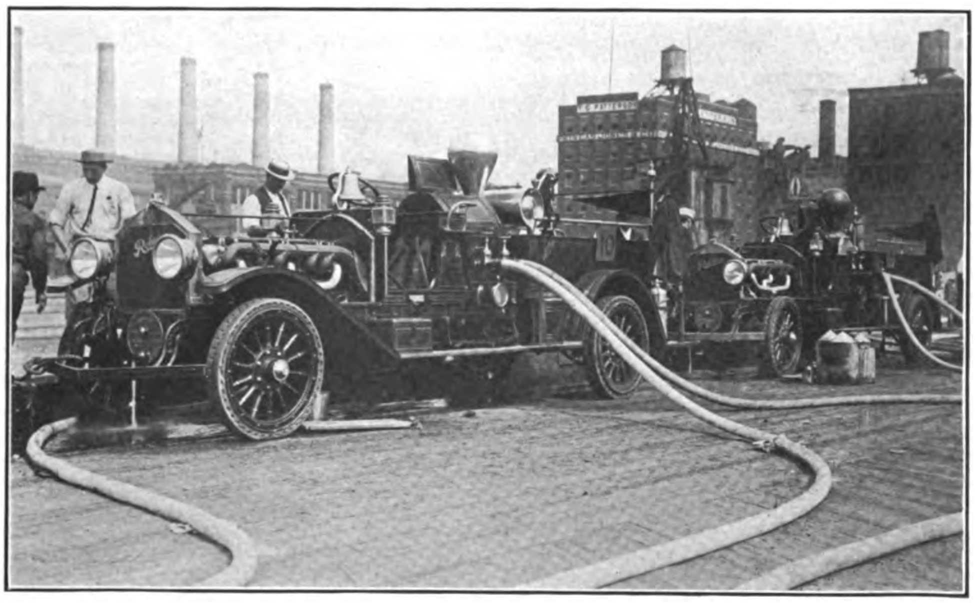
The convention was convened at noon, Labor Day, when President H. F. Magee of Dallas, Tex., called the delegates to order. Following invocation by Chaplain Handel of the New York fire department, Chief John Kenlon of New York City introduced Fire Commissioner Joseph Johnson of New York, who welcomed the firemen, and response was made by Chief Charles H. Henderson of Bradford, Penn. There were short addresses by Chief Kenlon, Chief M. J. Meier, Arthur R. Dyer and Major E. C. Walker, these three gentlemen being made honorary members of the association. W. H. Johnson, former chief of the Philadelphia, Penn., department, who is one of the two survivors of the founders of the association, was introduced to the delegates at the afternoon session, and a letter was ordered sent to Thomas B. Rowland of Norfolk, Va., who shared with Mr. Johnson the honor of being a founder. At this session the first paper was read by Chief A. V. Bennett of Birmingham, Ala., on "Motor Apparatus, Its Durability, Efficiency and Economy of Operation," which was generally in advocacy of self-propelled equipment, emphasizing the greater efficiency and economy through its use, and making comparative statements of possibilities.

Chief Bennett's Address.

"The world does not evolve or revolve backwards," said Helen Kellar, the blind and deaf genius. We who have eyes to see and ears to hear are forced to appreciate the wisdom of this observation. For, at the present time, in this "Twentieth Century," we stand in the midst of a very maelstrom of action and progress. Our every word, our every thought and action should mean a step forward. The world, which for ages has been the slave of ignorance and superstition, is at last being freed by the dissemination of knowledge. The nations have been awakened from their sleep, and the sun rays of truth are piercing the innermost nooks and corners of our world.

This awakening, this realization of things undreamed of 50 years ago, is in a great part due to the advancement of science. Where 100 years ago stretched the unbroken wilderness and the long silence, only now and then broken by the battle cry of the savage, or the voices of the forest, there now rise cities of such magnitude, of such grandeur, that even Aladdin with his magic lamp could not conceive. The ocean, formerly a place of mythical monsters and unknown dangers, has now become the pathway of men, and giant greyhounds, with all the luxury and pomp of a metropolis, sail the main and well nigh unite the shores of two worlds.

The mountain fastnesses of the Rockies and the Andes have been penetrated by creeping, shining bands of steel, and the highest promontories of the Alps now resound with the footsteps of men. The forces of nature are being harnessed and the very elements themselvs drawn upon for power. The rushing waters of the cataract, the dormant power of oil, are being utilized to work for men. Every nook and cranny of the earth



Two Robinson Six-Cylinder Pumps, the 900-Gallon Monarch in Front and the 750-Gallon Jumbo in the Rear, During the Second Period of the Test.

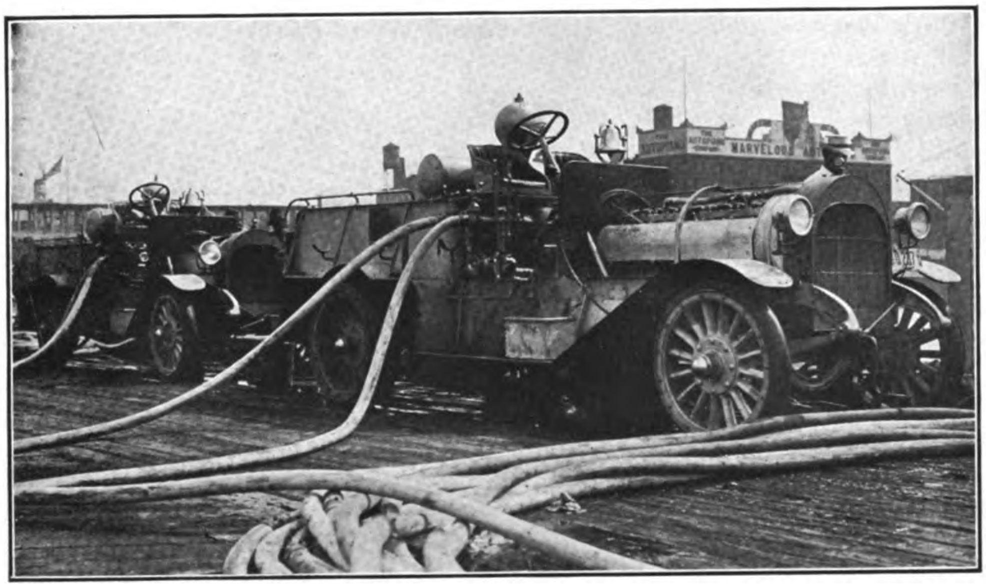
has responded in sweet harmony when the sympathetic chord of "mother nature's" heart was sounded by the instrument of knowledge. Not only in the progressive countries of America; not only in the old civilization of Europe; but even in the Orient, where legend and mystery still haunt the air; even on the trackless deserts of the Sahara, with lonely caravans travelling to the lands of the "rising sun" has the light of advancement penetrated.

Through sublime self-sacrifice and heroism, through bitter pain and struggles, the relentless ambition of man has carried him forward to the furthermost ends of the earth; crossing the barriers of snow and plowing through the mountains of everlasting ice, man has advanced to the very poles themselves.

With this wonderful progress of science, it is not at all surprising that man should be confronted by new difficulties, and by new problems of living. For many years the trend of population has been toward the city, and, as a result, there now arise skyscrapers, which are veritable beehives of human habitation. Giant commercial and manufacturing establishments, tenements and apartment houses are representatives of the new order of construction.

In the old days, when three or four stories were considered the limit, as far as height was concerned, when the houses were built farther apart, when congestion was not so acute, fire fighting was a far different problem from that of today. Progress brought about these new conditions, and it devolved on the same forces to bring the fire department up to the standard by which it would be able to meet the added difficulties. Just as the problems of streets, sanitation and water were met, so did the inventive genius of the times find a solution for the fire fighter, which is evidenced by the aerial ladder, by the water tower, by the powerful high pressure streams, and the various other devices with which we are all entirely familiar.

The desperate rivalry existing between our cities and their mad race to excel their neighbor in population has prompted the extension of the corporate limits from time to time so as to include vast tracts of sparsely settled territory. This, together with the automobile and the trolley car, has introduced a new condition and developed new difficulties for those who were charged with the duty of furnishing fire protection.



Two Nott Pumps, the Six-Cylinder 800-Gallon Machine in the Foreground and the Four-Cylinder 600-Gallon Engine in the Background.

The automobile has enabled the man of wealth to establish a home in the outlying districts, where he may enjoy the comforts of country life and still be near the scene of his daily activity. The trolley car has made it possible for the man of moderate means to establish himself in the suburbs, where he and his family can live in surroundings that would cost him twice as much were his home in the heart of the city.

The country and suburban movements have grown to tremendous proportions during the past few years, and at the present time we are experiencing the heyday of their popularity. The people who have become commuters and still reside in the city, are as much entitled to fire protection as those who reside in the heart of the congested district. In an effort to meet these new conditions, even those municipalities that were erecting new fire stations, and providing additional men and equipment each year, still found themselves confronted with vast expanses of territory that was too far to be reached in time to render efficient service with the horse drawn machine.

To provide means of transporting men and appliances over larger areas fast enough to do successful fire fighting; to provide efficient fire protection for vast stretches of sparsely settled territory, was a problem that again called into service the inventive genius, who, after years of earnest effort, hardship and disappointment, and the expenditure of huge sums of money by the manufacturer, has at last succeeded in giving us the modern, efficient and reliable self-propelled fire apparatus.

The motorizing of a fire department, however, like all radical changes from an established custom, is fraught with many difficulties, and means far more than merely consigning the faithful fire horse to green pastures, and substituting the tireless machine to perform his duty. One of the first, and perhaps the greatest problems with which you are confronted, is the proper training of men to operate the machines successfully. This is especially true of cities that are too small, or for other reasons, are unable to establish and maintain regular training schools.

To the average citizen who sees our streets thronged with automobiles driven by women and children and irresponsible men, the driving of a piece of motor fire apparatus to a fire is an act of small consequence, and requiring little ability or training. Such, however, is not the case, as is evidenced by the many accidents, fatal and otherwise, that have occurred throughout our country since the introduction of the motor machine.

In the first place, your motor fire apparatus driver is a fireman, animated by all the enthusiasm that permeates the profession. This prompts the desire to reach the scene of fire at the earliest possible moment, that he and his company may give the best account of themselves in the fight which is to be made. This enthusiasm, which, of course, must not be destroyed, has a tendency to recklessness, and the reckless driving of a heavy piece of motor fire apparatus through crowded streets is dangerous to the public and ruinous to the machine, and sooner or later results disastrously.

After you have succeeded in training a member of your department to be a careful and successful driver of your motor machine, you have taught him a new trade, and his services are immediately in demand by owners of commercial vehicles, who are in position to pay better salaries or to offer shorter hours, with the result that your best men are often lost to your department when their services are most valuable.

The useless racing of the engine while the car is standing; the engaging of the clutch with the engine racing in starting the car, causing extreme and unnecessary strain on every part of the apparatus, even to twisting the frame work; the engaging of the transmission gears before the clutch has ceased to revolve, and the engaging of the reverse gear while the car is in forward motion; the too rapid driving of machine to the immediate scene of the fire, or to quarters on returning, necessitating the too rigid application of brakes, subjecting the car to useless strain and costly repairs to wheels and tires; the reckless driving of the machine around street corners, causing unnecessary strain on all the parts, inducing skidding and resulting in many unnecessary accidents; fast driving over cobblestones, grade crossings and rough streets, which tends to crystallize axles, steering knuckles, etc., are a few of the things that your inexperienced driver is apt to do. In the motorizing of your fire department, many other problems are to be solved, but the durability, efficiency and economy of operation of your machine depend almost entirely on the care, judgment and skill of the driver in the handling of the car.

The durability of the motor machine, if properly handled, should be almost indefinite, since its radius of action is comparatively small, and its mileage a year in many instances less than 100 miles, and in very few cases exceeding 500 miles. In the majority of alarms answered the entire distance to and from the fire is over paved or well kept streets, which reduces the wear and tear of the machine to a minimum.

Efficiency.

The motor's chief claim to efficiency is its speed and ability to continue indefinitely without tiring. By its speed we are enabled to extend its radius of action over a territory two or three times as great as that covered by the horse drawn machine and still obtain efficient fire service.

We have, on several occasions, covered a distance of three or four miles with our motor machines and extinguished fires with small damage, originating in ordinary frame residences. Of course, this does not mean that the number of companies or the number of men employed before the installation of the motor should be reduced, for in the handling of large fires, in your congested district, you will unquestionably require the services of as many men and as many pieces of apparatus as formerly.

Nor does the motorizing of your department mean that you will only be required to establish engine houses in a radius of three or four miles of each other in your densely populated residence section. But it should mean more efficient service in all sections of your city and that engine houses will not be required in the immediate vicinity in order to furnish protection to your sparsely settled territory.

The motor machine perhaps in no way more clearly demonstrates its efficiency than in the prompt manner in which second alarm companies reach the scene of the fire. This is especially true in the residential sections of the smaller cities, where second alarm companies have a great distance to trav-

erse. Their prompt arrival on the scene is always a source of gratification to the officer in charge.

Reliability.

The reliability of motor apparatus has been a question of grave concern among fire department officials and others interested in fire protection. Such questions, as, Will the motor negotiate steep hills? or muddy streets? or deep sand? soft and hard snow? have been the subject of much correspondence between officials whose cities had already bought, and those who were contemplating buying the modern equipment.

By actual tests the motor has proven to be as free from break downs and delays, if properly handled, as the horse drawn machine, and should be considered equally as reliable and trustworthy under all circumstances. In negotiating hills your motor will climb grades with comparative ease that it is impossible to ascend with the horse drawn machine. In muddy streets, through sand or snow, if your motor machine can get traction it will plow through bad stretches where one pair of horses hauling your heavy fire apparatus would be sure to fail.

Economy of Operation.

The cost of operating motor fire apparatus is rather difficult to determine accurately as yet, because of the uncertainty of depreciation and necessary repairs due to actual wear and tear. The expense of operation, however, is largely controlled by the ability and care of the driver in the handling of your machine, who will raise the cost to abnormal proportions, or lower it decidedly below that of the horse drawn machine doing the same work, proportionately, as he exercises skill and judgment in his driving.

Tire equipment will necessarily be one of the factors in the cost of operation. The pneumatic tire possesses many advantages, such as resiliency and traction; is less liable to skid, and protects the machine against rough driving; but the ever-present danger of a puncture or blow-out, often putting the machine out of commission to change or repair tires, and the expense of frequent replacements render the pneumatic far from being the ideal tire.

The solid tire too has its advantages and disadvantages. The danger of punctures and blow-outs is entirely eliminated, and this equipment is durable and thoroughly reliable. With dual tires on the rear wheels, sufficient traction is obtained to carry the machine where you might reasonably expect to go, but the vibration to which your machine is subjected while being rapidly driven, especially over rough streets, necessitates many repairs and sooner or later sends the car to the shop for a general overhauling.

The cushion tire combines many of the good qualities of both the pneumatic and the solid, but does not possess the durability of the latter, and is correspondingly more expensive.

The actual cost of operating motor apparatus, exclusive of wear and tear and depreciation, is very small as compared with the horse drawn machine.

We have cars in service on which the cost of operation has averaged less than $3 a month since their installation, which was nearly three years ago. We also have machines in service which during the last 18 months have not required one penny's worth of repairs.

George W. Booth of the National Board of Fire Underwriters submitted a report to the National Fire Protection Association this year in which he embodied a table of comparative cost between the horse drawn and motor driven machines, which is so nearly correct that I am taking the liberty of reproducing it, as follows:

Hose Wagon—Horse Drawn.

	Cost a year.
Cost, $2000.	
Interest at 4½ per cent	$90
Depreciation (based on life of 25 years)	45
Repairs and tires	30
Total	$165

Steam Fire Engine.

Cost, $5500.	
Interest at 4½ per cent	$247
Depreciation (based on life of 25 years)	124
One new boiler and general overhauling—$2000	84
Tires and repairs	70
Total yearly cost for engine	$525
Interest, depreciation and coal for heater	90
Total	$615

Two Horses.

Cost, $600.	
Interest at 4½ per cent	$27
Depreciation (based on life of seven years)	60
Shoeing	90
Veterinary	25
Harness	6
Forage	300
Total	$508

Two-Wheel Tractor.

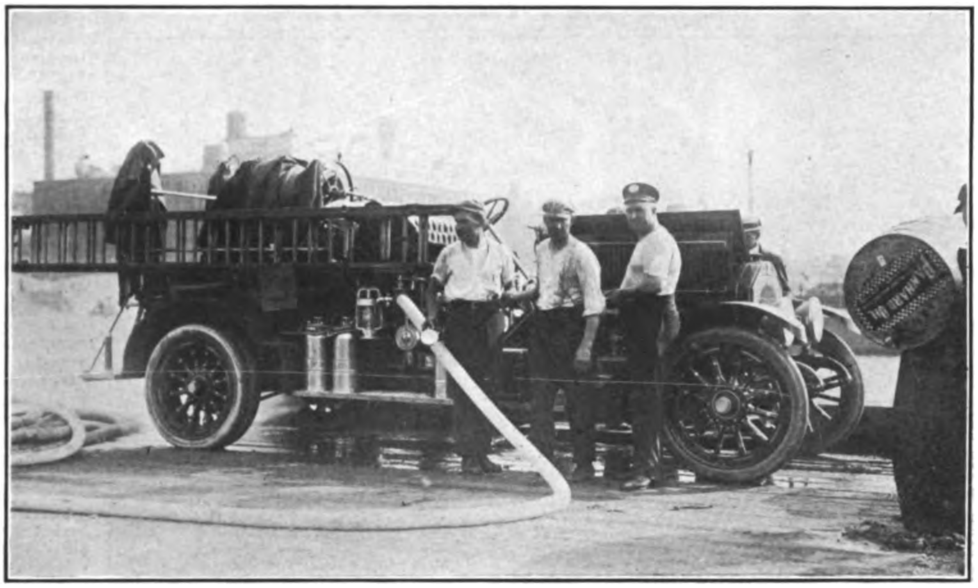
Cost, $4000.	
Interest at 4½ per cent	$180
Depreciation (based on life of 25 years)	90
Repairs (nine cents a mile)	45
Tires	40
Operating (seven cents a mile)	35
Total	$390

Automobile Hose Wagon.

Cost, $5000.	
Interest at 4½ per cent	$225
Depreciation (based on life of 25 years)	112
Repairs (nine cents a mile)	45
Tires	60
Operating (seven cents a mile)	35
Total	$477

Automobile Combination Pumping Engine and Hose Wagon "Z."

Cost, $9000.	
Interest at 4½ per cent	$405
Depreciation (based on life of 25 years)	202
Tires	80
Repairs (10 cents a mile)	50
Operation (eight cents a mile)	40
Total	$777



American-La France Six-Cylinder 700-Gallon Pump with Its Crew and an Observer Working to Its Greatest Capacity.

Steam Fire Engine with Tractor.

Cost, $9000.	
Interest at 4½ per cent	$405
Depreciation (based on life of 25 years)	202
New boiler, etc	84
Heater cost	90
Repairs and tires	125
Operation of tractor	35
Total	$941

Summary.

Steam fire engine, horse drawn	$1125
Hose wagon, horse drawn	675
Total	$1800
Steam fire engine and tractor	$940
Automobile hose wagon	480
Total	$1420
Automobile combination pumping engine and hose wagon	$780
Automobile hose wagon	480

Cost of operating at fires for five-hour run, with two good streams:

Steam fire engine—Four tons of coal at $5	$20
Gasoline engine—60 gallons gasoline at 17 cents	10

It will be noted that Mr. Booth uses as a basis a yearly total of 500 miles to be covered by each type of machine. In the average city this is at least twice the mileage that would be made, taking the entire number of machines in service as a whole. And the cost of operation will be correspondingly reduced with the motor driven, but would not be with the horse-

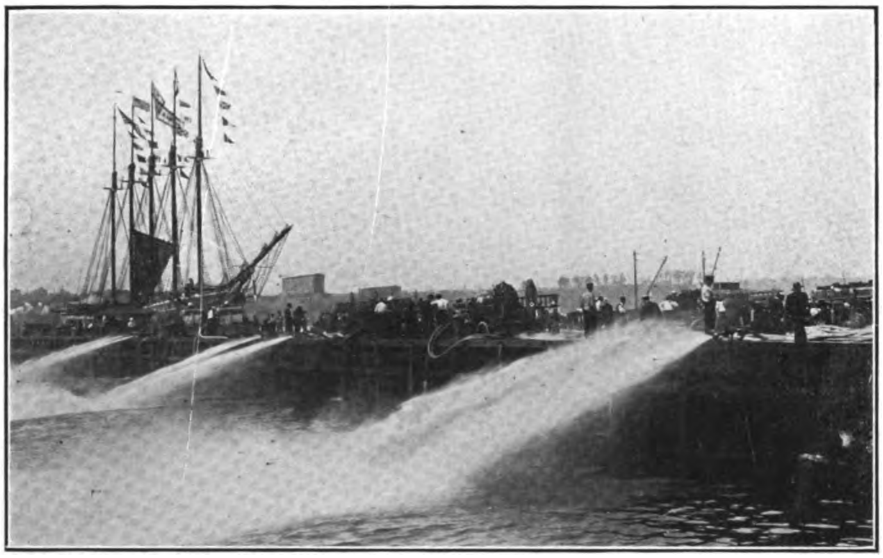
drawn machine, as the cost of maintenance is about the same for the horse, whether he answers an alarm or stands in quarters.

The march of progress cannot be halted. Self-propelled fire apparatus, as the product of this progress, is rapidly making mighty inroads on the old methods of the fire fighting service. The growing favor of the motor car is in no way more concretely illustrated than in the recital of the fact that my home city, Birmingham, Ala., less than three years ago, with its 24 pieces of motor driven fire apparatus, ranked first as far as equipment of this kind in relation to population was concerned. But, today, what a change! With the same number of pieces in service she has dropped down to 36 in the list.

This wonderful increase in the use of the new equipment is not due to a mere desire to get in line, to be more modern than our neighbor cities, but to far more substantial reasons. It has been brought about because it is more economical; because it is more sanitary; because immediately after our longest, hardest runs, it is ready to respond to the next call; because it will continue indefinitely without tiring. These facts are stronger than all the eulogistic tributes that might be paid the new type vehicle. They are based on every day use and experience. They stand out indisputable, uncontrovertible, invincible, and lead to one inevitable conclusion, motor driven fire apparatus is not a luxury, but a vital necessity.

At the conclusion of brief discussion the following paper on "Motor Apparatus as Used in the London Fire Brigade, 1912," was read by Arthur Reginald Dyer of the London fire department:

Before entering on the subject of motor fire appliances, a brief explanation of the system adopted in London of dispatching appliances in response to calls is subjoined, in order that the conference may understand the duties required from the various types adopted.



Streams of Water, Two Thrown by Each Engine, During the Six-Hour Test, When the Pumping Was Made at a Pressure of 120 Pounds.

The area to be protected is 117 square miles, which, with the exception of the public parks and some small areas at the extremities of the Metropolis, is entirely covered with buildings. There are at present for this area 85 land fire stations and three floating stations; of the former 18 are entirely equipped with motors and 12 partially so.

Each station is equipped with a fire escape van carrying a ladder capable of being extended to at least 50 feet and also furnished with supplementary ladders, hose and tools for getting to work from hydrants, and a cylinder holding about 30 gallons of water, fitted with 180 feet of rubber garden hose, .75 inch inside diameter, for extinguishing small fires. This appliance, the crew of which is on duty night and day, is ready for an instantaneous turn-out and only attends fires on the ground immediately protected by the station, the distance it may travel to fires rarely exceeds one mile. The yearly mileage of escape vans is about 600 a machine.

Most stations are also equipped with an engine or motor pump, and in a few localities with two engines, all of which carry hose, etc. These engines besides attending fires in the vicinity of the stations at which they are kept, are considered available for service at any fire in the area protected. The yearly mileage may be taken at 1200 a machine, but in addition they perform heavy duty pumping at fires sometimes for 24 hours without intermission.

Stations in localities where there are many high or warehouse buildings, are equipped with long ladders extending from 75 to 90 feet; these appliances while intended, generally speaking, for attending local calls, are considered available in case of serious fires in high buildings within a radius of about five miles. The yearly mileage run does not exceed 1000 a machine.

Other motor appliances in use are lorries (trucks) for carrying on from the central stations, coal and oil fuel for the steam fire engines, petrol (gasoline) for motor pumps, and also additional hose and acetylene water lights, etc., to large fires, and delivering stores regularly to stations; tenders for taking on the principal officers and their orderlies to fires, and also self-contained oxygen smoke helmets, cellar pipes, marine torches (acetylene), etc.; instruction tenders for training the men undergoing instruction in motor driving. These are not the oldest motor appliances available, but modern ones with chassis similar to those in use for pumps, escape vans, etc.

Motor cars for officers have been in use since 1901 and shortly after that an attempt was made to draw an existing land steam fire engine by a motor tractor, the front axle being removed, making altogether a six-wheeled appliance. It was found impossible, however, to travel at sufficiently high speeds with this without undue skidding and the principle was abandoned.

In 1902 an existing steam fire engine was converted to a motor engine by providing a separate engine for propulsion, the steam being supplied by the fire engine boiler; after a time, however, this was abandoned and the appliance was reconstructed for horse traction.

The first success in replacing horsed fire engines and horsed escape vans by mechanically driven vehicles occurred in 1905-1906, when steam motor fire engines and petrol motor escape vans were obtained. With the former it was found that as the appliance had to be ready for an immediate turn-out, a pressure from 80 to 100 pounds a square inch had to be maintained in the boiler, and owing to the excessive vibration on this type of boiler on the road, necessitating considerable repairs, and also to the large expense incurred in maintaining this pressure by gas, the steam system was abandoned.

With regard to the petrol motor escape vans, the first supplied only gave moderate satisfaction as manufacturers generally had no experience in the running of motors (weighing about 11,200 pounds with load) at speeds exceeding 20 miles an hour to guide them, the principal defects being under-tiring, want of sufficient strength in the fittings to withstand the excessive vibration, and inadequate springing. Indeed, prior to 1910 it was considered necessary to have one spare escape van for every one on duty in order to maintain an efficient service, whereas at present only one in five motor escape vans or motor pumps is necessary. The experience with early petrol fire engines fitted with pumps was somewhat similar.

From the first introduction of heavy engines capable of high speed the problem of providing a satisfactory non-skid engaged attention. Some mitigation of the inconvenience was found by utilizing chains festooned diagonally across the tires, but considerable damage was caused to the rubber, which, when worn, allowed the chains to come in contact with the iron rims, causing the non-skid chains to break and not unfrequently jam in the driving chains, or to allow the loose ends to tear the mudguards, etc. Other devices were tried to check the tendency to skid, such as studded leather covers and transverse bands of steel studded balata belting fitted into slots cut into the rubber of the tire. The latter were found to be most effective when tires and bands were new, but gave endless trouble when partly worn.

One motor pump was fitted experimentally with a gyroscope behind the radiator, but it was removed as a swaying motion was set up when travelling at high speeds. In addition to this the steering was rendered uncertain.

One appliance has run for a year without non-skids, but with soft rubber tires of flat tread and extra wide section, single on front wheels, twin on hind wheels; although no skidding has taken place there is still some doubt if fire engines can be safely run under all conditions in London without some non-skid attachment.

Front wheel brakes were tried on the appliances supplied by different manufacturers in 1910 in order (it was hoped) to obviate the effects of skidding, but while satisfactory results were obtained on tests they were found unsuitable in practise and have now been removed from the appliances and rear wheel or differential brakes fitted in lieu.

The difficulties formerly experienced have now been fairly overcome as follows: (a) By careful training and the continued experience of drivers; (b) by allowing greater cross section in tires; (c) by extra heavy leather steel studded covers fitted on two wheels only, one front wheel and one hind wheel.

The author has up to now referred only to early attempts to introduce motor traction in the place of horses and the experience gained was extremely valuable both to the fire brigade officials and the manufacturers.

It is now proposed to deal only with what may be termed motor appliances at present in use:

(1) Escape vans.
(2) Pumps.
(3) Turntable ladders.
(4) Lorries.
(5) Tenders.
(6) Cars.

Escape Vans.

Perhaps the most successful type of appliance to be introduced has been the electric motor escape van, for service in localities where only moderate gradients are encountered, the first of this kind being obtained in 1911.

The power is provided by a battery of 84 cells of 195 ampere-hours capacity, giving a normal running output of about 30 horsepower. The appliance runs about 30 miles on one charge if necessary, but owing to the nature of its service it stands fully charged ready to give out the maximum output on receipt of a call.

The motors are in the front wheels, the fields being fixed to the stub axle around which the armature revolves with the wheel. The tires are single five-inch on all wheels.

There are electric brakes on the front wheel motors which are valuable in emergencies, while two mechanical brakes on the rear wheels are sufficient under ordinary circumstances. The control is of the series-parallel type with five notches forward and reverse, and two brake positions.

The weight of the appliance ready for running, but without ladders, hose and small gear and men, does not exceed 8300 pounds. The total weight of the machine complete being about 11,800 pounds. A speed of 25 miles an hour is maintained with full load on a level and good road, and the machine is capable of ascending a gradient of one in eight fully laden, at a speed of about six mph or a moderate gradient at 15 mph.

The weight of the appliance fully laden is about 600 pounds more than a corresponding petrol van. Undoubtedly petrol motor escape vans are required for localities where stiff gradients have to be encountered.

The type found satisfactory has the following general features: Four-cylinder engine, five-inch bore by 5.5-inch stroke, giving about 50 brake horsepower; double ignition, Bosch magneto and accumulator and coil; speed about 30 miles an hour.

The engine is started up in the station every four hours, day and night. Where the engine room at the station is not warmed with hot water or gas radiators, electric heaters are hung over the front of the radiator to warm the engine and keep it ready for an immediate start in cold weather.

The appliance weighs about 11,200 pounds fully laden and has 4.5-inch tires on front wheels and 5.5 on rear.

Pumps.

A modern petrol pump used in the London fire brigade has a four-cylinder engine, five-inch bore and 7.125-inch stroke, giving 58 brake horsepower at 1000 revolutions a minute and 65 bhp at 1100 rpm. Speed, 30-40 mph. Weight, about 11,200 pounds fully laden with men, gear and hose. Tires are single 4.5-inch front and single 5.5-inch rear. The pump is centrifugal (usually termed turbine) and geared up from the engine. It is placed at the rear of the appliance and can be controlled from there or from the driver's seat.

It is now found that for London the two, three or four-stage centrifugal pump is capable of fulfilling all the required conditions and only this type has latterly been specified. The pump gives an output of 500 English gallons (American, 600 gallons,) a minute at a working pressure of over 120 pounds a square inch.

There is a considerable controversy among fire engineers in Great Britain as to whether the reciprocating or centrifugal pump is the most suitable for the duty required of fire engines. The mechanical efficiency of the reciprocating pump is 10 to 15 per cent. higher than the centrifugal; the pump can run slower when discharging a small quantity of water at high pressure and can pick up its own water when drawing from a canal or dock without the aid of a vacuum pump, which is necessary for the latter.

The centrifugal pump has to run fast in order to obtain even a small quantity at high pressure. On the other hand when delivering at lower pressures a larger volume can be delivered than from the reciprocating.

One great advantage of the centrifugal pump is the possibility of working two pumps in series when a high pressure is required, or in parallel when a large volume is required for one jet. Under the former conditions an efficient jet was thrown over the top of St. Paul's Cathedral 340 feet above pavement level. The jets commonly obtained from standard large sized American steam fire engines can also be obtained by working two of the smaller capacity motor pumps as described above.

In London it is necessary that in addition to the pump at least 600 feet of rubber lined canvas hose 2.75 inches inside diameter, besides the necessary small gear (see appendix), and five men must be carried. The speed of the appliance is greater than that of motor escape vans.

Although at present in the outlying suburban stations smaller horsed steam fire engines are stationed than those in the central area stations where the fire risk is greater, it has been found best to equip the former stations with the same sized motor pump as in use elsewhere, as the additional pumping capacity is available when an engine is ordered on to large fires, also the additional distance to be covered need not be considered as in the case of horsed engines.

At present the brigade is only equipped with two motor turntable long ladders. These can be extended to a height of 90 feet and can be safely used as a water tower at a height of 60 feet. In both cases the system of propulsion is by electric storage batteries and hub motors in the wheels. In one design the wheel motors are interchangeable with those on the motor vans for carrying escapes and drive on the front wheels. In another type the battery is of the same capacity and manufacture, but the motors are fitted to the rear wheels.

It is not considered necessary to specify for these appliances to travel at a speed of more than 20 mph. The total weight of the appliance with ladders is about 13,800 pounds.

It is probable that by adopting motor long ladders a number of the existing horsed long ladders will be dispensed with two of which are being adapted for electric traction.

Lorries.

The first lorry to be procured was a standard five-ton (11,200 pounds) machine from one of the largest lorry builders. It is fitted with a four-cylinder engine 5.5-inch bore and 6.5-inch stroke, having an output of 55 bhp at 1000 rpm, and is capable of a speed of 30 mph. It is fitted with five-inch tires on front wheels and twin five-inch on rear. No non-skids are provided. A covered hood is fixed.

A second lorry has been ordered. This will be one of the standard three-ton (6720 pounds) type, similar in most respects to the larger machine. It will have a four-cylinder engine, 4.75-inch bore and five-inch stroke, giving an output of 45 bhp at 1000 rpm. This machine will be kept at the chief station in one of the districts and will be used in a similar manner to the other appliance.

Motor Tenders.

Those at present in use for carrying principal officers to fires and other work are standard chassis by well known makers. In one case large pneumatic tires 35.5 by 5.5 inches (895x135 mm) are fitted, with detachable rims. On this machine four men are carried, besides the gear mentioned previously, the total weight being 4410 pounds, and no trouble has been experienced with the pneumatic tires. Indeed, the instruction tender, which is of similar pattern and drive, has also been recently adapted for pneumatic tires instead of solid ones.

Knox Six-Cylinder 600-Gallon Engine with a Pile of Reserve Hose in Front of It—A Typical Scene During the Trials.

At some suburban stations motor tenders are located in addition to the motor escape van, that in the event of the latter being required elsewhere the tender may be at once dispatched with sufficient men, hose, hook ladders, etc.

Motor Cars.

The cars in use, of which there are 13, are of standard pattern by well known makers, and are mostly fitted as touring cars. They are used both for inspection work and also for proceeding to fires. The superintendents in each of the six districts are now provided with two-seater touring cars for daily inspection of the stations in their districts, also for taking them on to fires. Smoke helmets are carried in those cars.

The author has not endeavored to enter into details of the appliances, but subjoined are complete specifications of the principal machines to which the makers have to tender, and in connection with this it has been found advisable to restrict the number of types in the service, in order that the drivers when transferred from one appliance to another in the station or district can drive the appliance efficiently. In future endeavors will be made for only machines of one make to be allocated to a station.

In the early days of motors, specifications were drawn up by technical officers of the brigade, but with the exception of details it is now found advisable for the manufacturers to supply their standard type of chassis adopted to the conditions of the London fire brigade, as they are in a position to replace any parts instantly from stock.

Perhaps one of the most important points with regard to the application of motors for fire brigade work is the question

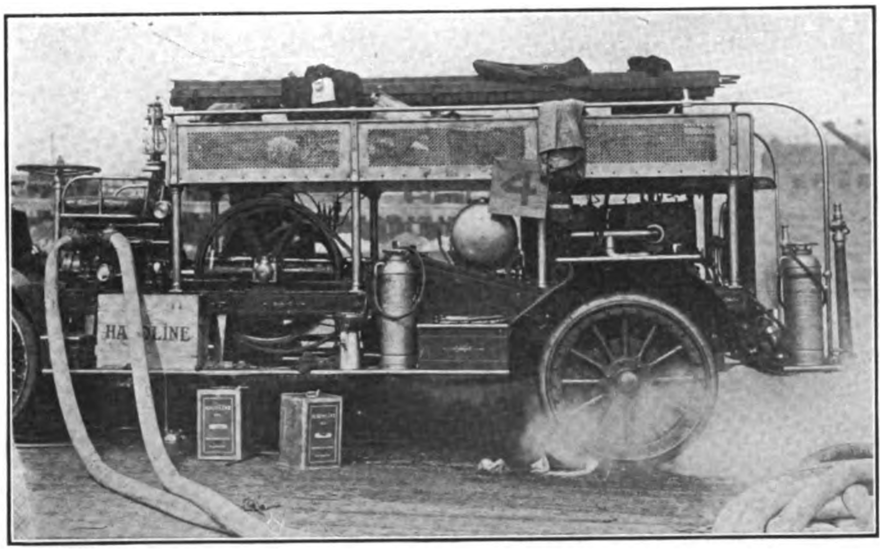
of the cost compared to horsed appliances. In the early stages it would not have been correct to say that any saving was shown in favor of motors, indeed the reverse was the case, but with the improved standard commercial type chassis which has been adopted, and the continued experience of the drivers, there is undoubtedly a saving effected by motor appliances.

The London fire brigade owns no horses. They are hired from the contractors at an average rate of £70 a year a horse, this sum includes bedding, fodder and harness; the contractor also takes all risks.

The following figures give comparison between the cost in maintenance of horsed and modern motor appliances, the repayment of cost of horsed appliances being spread over 25 years and for motors 10 years:

Horsed Appliances.

Appliance	Average first cost	Depreciation 25 years and interest at 3.5 per cent.	Repairs	Gas	Oil fuel	Horses, 2 at £70 each	Average annual maintenance
Steam fire engine	£350	£20. 7.4	£14	£32	£8	£140	£214. 7.4
Escape vans	65	3.15.8	9	..	..	140	152.15.8



Luitwieler Four-Cylinder 600-Gallon Engine, the Smallest in the Trials—A Novel Construction with the Motor at the Rear and the Pump Forward.

Motor Appliances.

Appliance	Average first cost	Depreciation (10 years) and interest at 3.5 per cent.	Average annual cost, repairs, including tires, etc.	Average annual cost, petrol, lubricating oil, grease, etc., and accessories	Total	Average annual mileage an appliance	Average running cost a mile in pence excluding depreciation and interest
Pumps	£900	£110	£40	£25	£175	1032	15.1
Petrol escape vans	750	90	30	15	135	522	20.6
Electric Current.							
Electric escape vans	£950	£115	£25	£8	£148	659	12.0

From the above it will be seen approximately that the saving with motor pumps is about £40 per machine per annum, petrol escape vans about £17, and for electric escape vans about £5 as compared with similar horsed appliances.

The total number of motor appliances required to complete the conversion of the brigade from horsed to motor traction in addition to those at present in the brigade and on order for this year will be as follows:

Escape vans (petrol or petrol-electric)	31
Escape vans (electric)	32
Motor pumps (petrol or petrol-electric)	64
Motor turntable ladders	23
Motor lorries	9
Motor canteen vans	1
Motor cars	2
Total	162

It is estimated that the cost for the above future appliances will be about £160,000.

The present equipment of the brigade, including the appliances on order is as follows:

Escape vans (petrol)	22
Escape vans (electric)	11
Motor pumps (petrol)	30
Motor turntable ladders	4
Motor lorries	2
Motor tenders	5
Motor cars	13
Total number of appliances	87
The ultimate total number will be	249

There are also in use two motor fire boats, as well as two steam driven vessels.

At the session the afternoon of the second day a paper on "The Motor Pumping Engine, Its Defects and Cost of Maintenance," was read by Charles S. Demarest, chief of construction of New York fire department, who has charge of the repair department of the New York department. Mr. Demarest has had a wide experience with every form of equipment and since the use of motor apparatus by the city of New York he has made a careful study of the requirements for maintenance. This has entailed observation of the possibilities for failure and damage in the service in the second largest city in the world, where fire protection has been probably more carefully considered than elsewhere in America. The metropolitan equipment must necessarily be subjected to greater and harder service than that in any other municipality, and with the exceedingly high structures, the large area, the mediocre streets, the congested traffic, and the very large number of fires, it must be kept at maximum efficiency. The maintenance of this apparatus has been Mr. Demarest's work for years, and his paper dealt with what he believes to be absolutely essential as a standard. The paper follows:

Mr. President and Members of the International Association of Fire Engineers:

Although an endeavor has been made to cover the subject assigned to me, it is probable that you will agree with me, after the completion of this paper, that the title should have been changed to "Some Defects and Troubles Experienced in Repairing Motor Fire Apparatus."

The motor pumping engine is yet a broad subject for discussion, but when we consider the standards set for it by the steam fire engine, which required a period of 60 years to bring it to its present state of perfection, we must all agree that the development of the motor pumping engine in the past two or three years has been wonderful. The New York department has so few pieces of motor pumping apparatus that actual service conditions will not be discussed to any large extent; however, experience with the large amount of other motor fire apparatus, and the rigid inspection of motor pumping engines made while taking part in tests of about every make on the market, have convinced the writer that the motor pumping engine cannot be classed, with its present design, as giving the same reliability as the steamer, although its performance in most every other respect has about equalled that of the steamer for the period of time during which they were run. We are all familiar with the performances and reliability of the steamer, and there is no reason in my mind why the motor pumping engine should not be just as reliable for fire service if the manufacturer would make a more exhaustive study of the conditions that actually exist at fires.

A motor behaves well in clear weather and many behave well on the road in a severe rain storm, but it has been our experience with several pieces of apparatus that they could not continue in service under conditions of rain and water liable to be encountered in fire service. Even with pleasure vehicles trouble is encountered; on July 28 of this year we had a severe rain storm which lasted for about one hour; during that storm,

between 59th and 115th street, there were six automobiles that were stalled, due to the ignition systems not being water proof or not being properly protected against a severe rain storm.

It is not an unusual condition in fire service to have eight to 25 engines at work, with hose lines running on all sides and probably underneath fire apparatus; a burst hose near a pumping engine, a deflected stream from a nozzle or heavy spray may completely drench a motor. Now, is the motor pumping engine, its magneto, ignition system and carburetor, so well housed that it will continue to perform under such conditions? There is no reason why these important parts of the motor cannot be so housed that the chances of the motor going out of commission are very remote when hit with a stream of water. It may be possible that a motor must have a certain amount of air current while running on the road, but this does not apply when the motor is pumping water, as all motor pumping engines are so constructed that you may regulate the cooling water from the fire pumps.

Recently the motor for a water tower could not be started after several hours service at a fire; on investigation it was found the spark coil, one of the best on the market, had got wet and would not operate; the water in this case had worked through the front, indicating the need of not only water proofing all parts of the spark coil, but of housing the front in such a way that water cannot reach it. If this had been a motor pumping engine it would have been put out of service, probably at the most critical stage of the fire.

Water proof magnetos are on the market, but do we get them on fire apparatus? Very few of the present makes are equipped with them, yet we learn of pumping engines failing at test because of water from leaky radiators being sprayed on them, and we know severe rains will put them out of service. Spark plugs, heated by long runs, have been known to have the porcelain insulation so badly cracked by water as to short circuit. The effect of water blowing into the carburetor would be serious, but no effort has been made to eliminate the danger and many are set in such a way as to invite water. It has been argued that because of the hood, the probability of water getting to these parts is very small. This cannot be accepted as a satisfactory statement with the present apparatus on the market; there is not today any motor pumping engine which can run for several hours without having to lift the hood to oil some moving part or refill an oil tank. In addition to having the above parts completely water proof, why should we not have all other parts so designed as not to have the cover touched during a long run? The carburetor for fire service should have very few adjustments and these adjustments should not become disarranged or have to be changed after properly adjusting. The oiling system should be so designed and located that it would not be necessary to raise the engine hood for oiling purposes while working at a fire.

In the preparation of this paper it was attempted, by tabulating actual daily report sheets kept in the New York repair shop, to obtain some first hand information of both the causes of accidents and repairs and the expenses resulting therefrom. Necessarily, the period over which our records extend is short, as the oldest pieces of automobile apparatus in the department have been in service less than five years, and during the first two years it was repaired mainly by the manufacturer under his guarantee.

One item very much worth looking into is the question of accidents and the comparative cost of repairs from this cause. Much faster speed is made with automobile apparatus and it takes a more experienced man to handle it than to drive horses. In fire department work it is practically impossible to always be sure to have a highly trained man to drive the apparatus, and at the high speeds at which he travels a "green" man is very liable to accident. Even though motor apparatus is more tractible and can be guided through places hard for horse drawn apparatus, the number of accidents due to poor handling is high and indicates a condition which must be overcome.

Our records show a cost of repairs due to accidents of $531 for one of our water towers, and of $757 for one of our pumping engines; these figures are given to show that when accidents occur, the speed and weight of the machine are usually such as to cause considerable damage and result in a large bill for repairs. Because of severity of the damage, it is particularly objectionable to have the apparatus of a complicated type; if you are not equipped to handle the situation the apparatus is out of service for an indefinite time and you may have to send hundreds of miles to get an expert to locate and repair your trouble.

The following figures are of interest, although the time over which the records go, i. e., 2.5 years, is not sufficient to give a true average:

Deputy Chiefs' Runabouts (Six Cars).

Average yearly cost a car for repairs due to accidents....	$44
Average yearly cost a car for other repairs..............	14

Automobile Hose Wagons (Seven).

Average yearly cost a wagon for repairs due to accidents..	45
Average yearly cost a wagon for other repairs............	110

Gasoline-Electric Aerial Ladder Trucks (Three).

Average yearly cost a truck for repairs due to accidents..	82
Average yearly cost a truck for other repairs............	81

These items do not include painting or new tires, which in many cases were necessary and materially increased the cost. Of the cost charged up against hose wagons and the ladder trucks, it was estimated after a careful looking over of the records and time sheets, that at least one-half the cost was due to faulty construction and to poor design.

From the repair standpoint there should be borne in mind three very important factors: No apparatus should be bought which is too complicated for the chauffeur to make minor repairs, or for the foreman of the repair shops to take to pieces and put back again; no apparatus should be purchased which is so built that it is hard to get at its parts and requires a partial or total disassembling to make most repairs, and no machine should be constructed with its parts so heavy that they cannot be readily handled.

That these three features are not always followed is evident to anyone having to do with the repairing of many of those on the market. The cost of repairs in many cases is excessive, due to unnecessary complications. For example, in some apparatus it is necessary to take down the entire transmission and jackshaft housing in order to replace a jackshaft, but if the jackshaft were of the full floating type all this unnecessary labor would be eliminated; in certain types, in order to get at the timing gears the entire motor has to be taken out; to put in a gasket on the exhaust manifold it should not be necessary to take down the steering column and dash; this is faulty construction and should be eliminated. A unit power plant is preferable, as it is not as liable to get out of line and is easier to handle when making repairs, as it can be taken out as a whole or can be taken apart.

The starting dog on the crankshaft should be keyed on as well as fastened with a pin; the shearing off of the pin, which has occurred in several cases where that was the only fastening, has resulted in serious injury to the timing gear.

The Pier During the Pumping Trials, Looking Toward the Head of the Dock, the Engines Being Located Close to the Cap Log at Either Side.

Drip pans should be made more readily removable; in many instances it takes an hour or more to remove this when some minor repair is necessary.

The method of transmitting power from the motor to the pump should be positive in its action and there should be no chance of slippage between the motor and pump when increased pressures are required. Some recent accidents seem to indicate that the driver has gone from full speed ahead direct to reverse; this should not be possible, and usually a simple stop of some kind can be attached without changing the design of the shift.

The multiple disc clutch is unsatisfactory because of the necessity of oiling and oiling just right; the cars so equipped in this department have given a great deal of trouble from these clutches being too dry and the gears being stripped when a change of speed was attempted. To oil and fix this type of clutch usually means putting the car out of service for quite a time and requires the removal of all hose on the apparatus. Although very satisfactory for touring car service, for fire service it should never be used.

Are the steering knuckles, cross steering tubes and their connections made of the best material and of sufficient strength to withstand fire service? With several makes of apparatus they have failed while responding to fires, and this failure is too serious to occur under even very severe conditions; the apparatus is out of service and probably sustains considerable damage, and, more important, the lives of the men are jeopardized. The wheel spindles, steering knuckles, cross steering tubes and their connections to the steering wheel should be stronger than on commercial apparatus, as the road conditions are more severe.

A heavy bumper should be provided on all fire apparatus, and it will more than pay for itself within a short time.

Besides the above, a study of accidents and repairs has

brought out the following:

The oiling systems should be positive and reliable; the gasoline tank should be made of copper and of sufficient capacity to run the engine at full capacity for four or five hours, and gasoline supply to carburetor should be by the gravity system so the tank can be replenished without interrupting the motor. There should be no soldered joints in the gasoline line and this line should have a shut-off close to tank and easily accessible, as well as a drain valve; the gasoline tank on pumping engines should have an arrangement whereby the operator can observe at all times the amount of gasoline in the tank.

The question of combined gasoline-electric drive is approached with limitation, as the manufacturers have gone to large expense in getting up this type of apparatus, presumably to meet the demands of fire chiefs. However, it is the writer's opinion that it is not the logical development and is certainly not desirable for the smaller places, where extensive shop facilities are not available and an electrician cannot be maintained. Besides increasing the first cost to a figure much beyond that for a tractor drawn piece of apparatus, it introduces the complications of extensive electric wiring; few men attached to repair shops can properly care for such apparatus and it is very unlikely that the operator will know even the first principles of maintenance of such apparatus.

As a broad statement, resulting from experience with all types of motor apparatus for fire service, it is evident that if the manufacturers do not pay more attention to their design as affecting reliability and ease of repair, it will be necessary for the fire chiefs to draw up more rigid specifications and detail drawings, which will require the manufacturers to modify their stock plans.

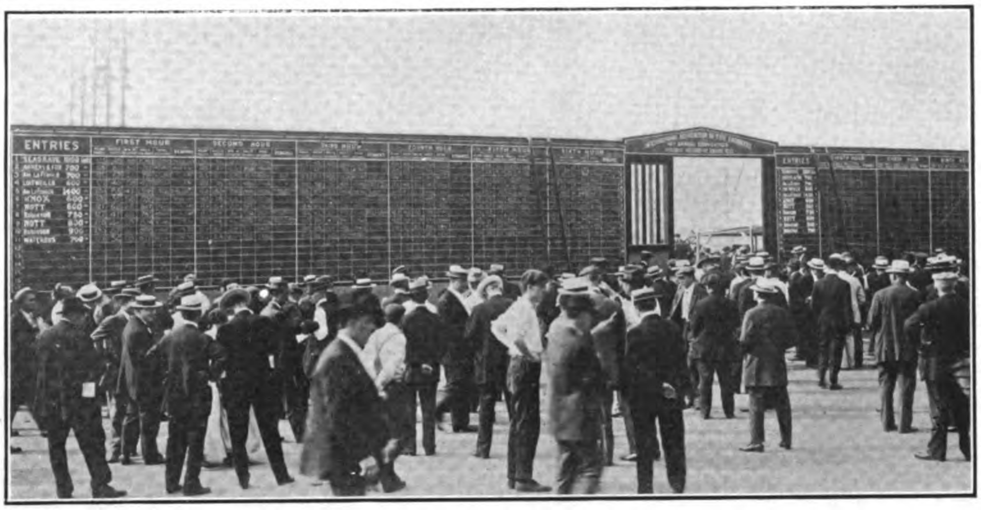
In buying motor fire apparatus, a city, particularly a small or moderate one, should stick to one make that will give the desired results, or at any rate adopt certain things to be standardized and make all bidders put those things on according to your standard. If tractors are bought, they should be required to be interchangeable, the bolted connection, turntable, or whatever is used, to be the same in each. There is no reason why wheels, axles, springs, brakes, carburetors, magnetos, batteries and spark plugs should not be standardized, thus cutting down the extra parts necessary to carry and make it easier to repair the apparatus; this will usually mean the employment of a mechanical draftsman to draw plans of these things, to be inserted in the specifications, but every up-to-date repair shop should have such a man, or should be able to employ one from the outside for the time needed. For the larger shops a graduate mechanical engineer, with about five years' experience, is almost a necessity; in our budget for next year we have asked for the creating of this position.

The subject of tire equipment is also too broad to permit of full treatment here. Delays, safety and cost are all items which must necessarily be considered. In some departments pneumatic tires are employed and it has been claimed that they are necessary with the high speed at which the apparatus runs. Because of the greater liability of accident when running at high speed, and also because fire apparatus is usually heavy, it appears unwise to exceed a speed of 25 to 30 miles an hour for fire service. A blow-out on a pneumatic tire while responding to an alarm usually means a serious accident. We have obtained excellent results from resilient solid tires; these insure freedom from the troubles of the pneumatic tire and we have experienced no difficulty with the apparatus because of any lack of cushion, although often operating at high speed. A guarantee of 8000 miles, same to be accomplished in three years, is given on tires we buy, this in consideration of the infrequent service of fire apparatus. Under this guarantee and the price at which these tires can be purchased, a low cost for tires a vehicle-mile is assured. Comparatively no trouble has been experienced in obtaining traction with this type of tire or with skidding.

The use of proper sizes to carry the various apparatus is one point which should not be overlooked. Apparatus employing tractors will show a greater percentage of front weight and this, as in the case on our engines, necessitates larger front tire equipment. Our hose wagons are of two types, both propelled through the rear wheels; one with motor under the seat and another type with motor in front of the driver's seat. On the first mentioned type the distribution of weight will approximate 40 per cent. on the front wheels and 60 per cent. on the rear. These cars will average 13,300 pounds, with full equipment. The second type mentioned will weigh approximately 9600 pounds with equipment and has a weight distribution of 20 per cent. on front wheels and 80 per cent. on rear wheels. Although the first of these wagons weighs more than the latter, we are enabled by the difference in weight distribution to employ the same size rear tires (36 by 3.5 dual) on both vehicles, a larger front tire, of course, being necessary on the heavier wagon because of the greater proportion of front weight. From this it will be seen that different makes of apparatus, although used for the same kind of work, vary in total weight as well as in its distribution, and these points should be carefully considered if the best results are to be obtained from the tire equipment.

Fire department service demands exceptional qualities in a tire because of the weights carried and the speed attained, which generates great heat and exerts powerful centrifugal force in the tires. Looking at this subject of tires from its various angles, we are satisfied, from our experience, that the solid rubber tire is generally well adapted for use on fire apparatus.

It might be of interest to the members of the association to discuss somewhat briefly the mechanical needs of a department having motor apparatus. The specifications should provide that a full kit of tools be supplied with each piece, for the purpose of making ordinary repairs and adjustments; also extra spark plugs, a liberal supply of bolts and nuts and an extra supply of valves and valve springs. For six pieces of apparatus of the same type a complete set of extra wheels, fully finished and equipped with tires, and for three, or a less number of such apparatus, one front and one rear wheel should be supplied; in side chain drive apparatus, a supply of extra links should be included.



Mammoth Score Board Across Pier Where the Engine Tests Took Place, the Results Being Posted Each Hour—The Figures Were Later Checked and Revised.

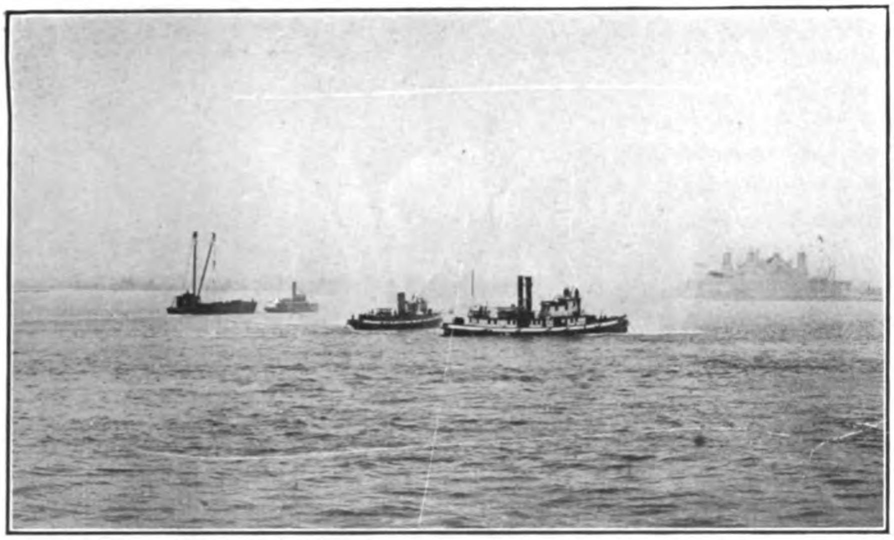
A repair shop in a small department should be equipped with:

One engine lathe, 18-inch swing, 10 feet long.
One drill press, 22-inch table.
One grindstone.
One blacksmith forge.
One portable crane, 2000 pounds capacity, for lifting out the motor, transmission, etc.
One hydraulic hose expander.
One hose testing outfit.
Two or more portable electric drills for holes up to one inch.
A tire repairing outfit.

A large department, in addition to above, should have:

One Monitor lathe, 18-inch swing, six feet long.
One engine lathe, 30-inch swing, 14 feet long.
One engine lathe, 24-inch swing, 12 feet long, with taper attachment.
Five engine lathes, 14-inch swing, 10 feet long, with taper attachment.
One radial drill press, with four-foot arm.
One drill press, 24-inch table.
One drill press, 18-inch table.
One sensitive drill press, 12-inch table.
One planer, eight feet by 26-inch bed.
One shaper, 16-inch stroke.
One Universal milling machine, No. 2.
One Universal milling machine, cutter grinder No. 2.
One power hack saw.
One emery wheel for grinding tools.
A stock of drills, reamers, stocks and dies, including A. L. A. M. standards, emery wheels for roughing down work, a couple of buffing and polishing machines.
A blacksmith shop with a power hammer, capacity of from two to 800 pounds, and a tire heater and shrinking plate.
A nickel plating outfit.
A paint shop.
A brass foundry with one molder (convenient and economical in large cities).
A woodworking shop comprising a wheel machine, band saw, circular saw, planer, variety molding machine, tenoning machine, woodturning lathe, sandpapering machine and a portable drill.

The policy of the association is that the city in which the convention is held shall provide an exhibition hall for the display of apparatus by the manufacturers and whatever equipment and assistance is nec-



Demonstration of the Fleet of Fireboats Off Battery Park, One of the Features of the Entertainment of the Visiting Fire Chiefs.

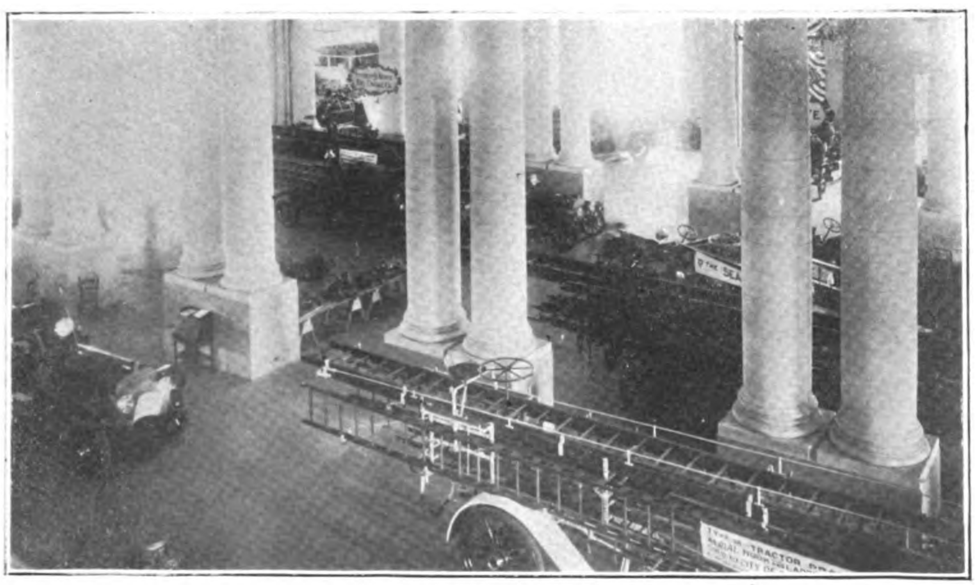
essary for conducting the trials that may be arranged in connection with the convention, and in keeping with this New York engaged Grand Central Palace for the show and for the convention, and secured a pier at the foot of 54th street for the tests of the machines.

Co-operating with the exhibition committee was a committee from the National Board of Fire Underwriters, which consisted of Wilbur A. Mallalieu, chairman; Chief John Kenlon, George W. Booth, Charles S. Demarest and James J. Henry, and the committee on tests of the New York general convention committee. The trials were arranged for with extreme care. Across the head of the pier a great score board was built with a gate in the centre, and on this was posted each hour the result of the work accomplished, but this was unofficial and was merely for the purpose of informing the delegates and others interested of the general working conditions. The committee had the assistance of nearly 100 members of the New York firemen and a sufficient number of police to keep the pier free for the pumping crews and to prevent possibility of interference from the curious.

The purpose was to have the trials equal to all entrants and to afford each the fullest opportunity for demonstrating the capacity of the machines. In connection with the trials the approximate capacities of the engines submitted for trial were determined by preliminary tests, and it was decided that the finals would be according to these conditions: Six hours' run at full capacity, at not less than 120 pounds net pressure, pumping through three streams siamesed into one nozzle; three hours' run at not less than half capacity, at not less than 200 pounds net pressure, pumping through one line of hose and nozzle; three hours' run at not less than 250 pounds net pressure, pumping through one line of hose and nozzle.

The full capacity test was begun at 6:30 in the morning and the trials were continued continuously with such intermissions as were necessary for changing hose, nozzles, etc. During the intermissions the entrants were expected to keep the motor running, and, if practicable, the pumps as well. The conditions to be observed were the following: The engines were each assigned a layout of hose and nozzles such as were found needful during the preliminary trials to insure the maintenance of the required pressure while delivering the rated capacities; the engines drew from the Hudson river with an average lift of 10 feet; but one suction line was permitted for each engine; the engines rated at less than 700 gallons a minute used suctions not more than 4.5 inches inside diameter, the engines rated from 700 to 850 gallons a minute used suctions not more than five inches diameter, and engines rated at 900 gallons a minute used six-inch suctions. Each competitor had the option at the conclusion of the 12 hours' test of continuing an indefinite period with a pressure not less than 120 pounds; not more than two men were allowed as an engine crew, but these men could be changed every three or six hours.

Gasoline of the same grade was supplied to all the machines and there was no specification as to the lubricating oil that should be used. There was no limitation as to the quantity of gasoline or oil used, but it was necessary that the fuel and lubricant consumed be noted. The tests were not open to the public, and only



Portion of the Main Floor of the Grand Central Palace, Where the Apparatus was Shown, as Seen from the Mezzanine Floor.

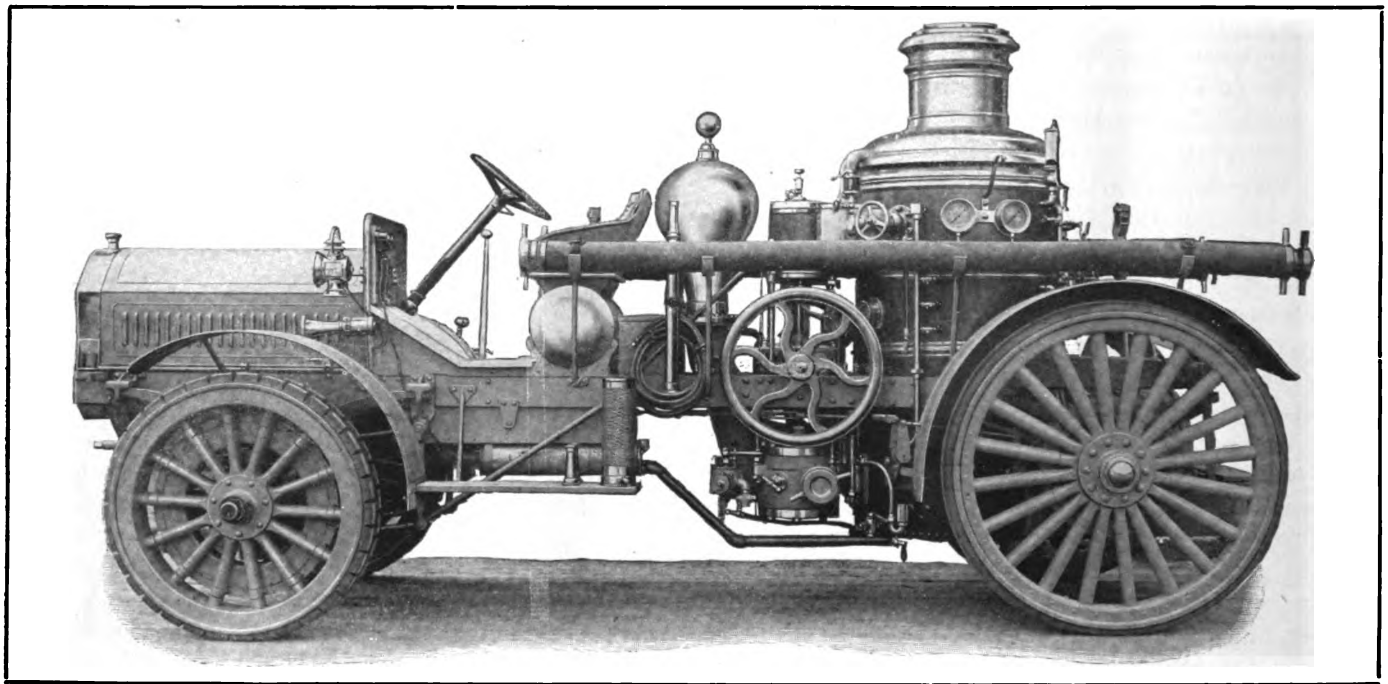
the members of the committee and assistants, engaged in recording results or operating the engines, and the necessary employees of the exhibitors were given access to the pier.

The committee stationed a horse drawn steam fire pump on the dock and at intervals of five minutes a signal for recording nozzle pressure was given by blowing the whistle of the engine, and 30 seconds later a second signal, the readings being made and noted between the blasts of the whistle. This insured uniformity of records for all machines and obviated the possibility of error or confusion incidental to individual time keeping.

Each engine was assigned a station and the machines were located close to the cap logs of the wharf and the nozzles were fixed on the cap logs, with the suction pipes dropped into the water sufficiently deep so that there was a sufficient supply of water no matter what the condition of the tide, and the variance of the water lift is shown by high water at 10:30 in the morning and 4:50 in the afternoon, when the records of maximum and minimum lift were taken, the difference in lift being accounted for by the height of the pumps above the deck of the dock.

Chief John Kenlon of the New York fire department was the executive and under his direction the tests were made without favor and with absolute fairness. He was assisted by Chairman Mallalieu and the compilation of the record was placed in the hands of the National Board of Fire Underwriters. The records were taken for each machine by two men, one reading the nozzle gauge and the other noting the result, and the reading for each machine was given to the chief clerk. The result of each hour's work was computed and posted on the mammoth score board, which extended across the shore end of the pier. The representatives of the manufacturers having charge of the machines were provided with score books in which they could note the work accomplished each hour, for their own or for all the pumps. No person had access to the official figures, and these were later on checked and tabulated with reference to each pump, the revised score being printed and with it the condition of each engine as found by the examining committee, inspection being made of the motors after the trials with reference to the bearings, pistons, cylinders, valves and all working parts.

The work of each engine was carefully noted throughout the test. The time and any conditions that caused loss of pressure, lessening of pumpage, cessation of operation, heating, breakage, loosening of bolts, defective ignition, faulty carburetion, changes from magneto to battery ignition, leaky valves or cylinders, skipping of cylinders, condition of bearings, condition of clutches, repairs of any nature, the cooling of bearings, and any fact that might be regarded as attention and aside from constant operation at the requirements of the test.



American & British Gasoline-Electric Two-Wheeled Tractor Coupled with Steam Fire Pump—One of the New Productions Shown at the Grand Central Palace.

The trials were such as might be expected under stress of a very serious fire, where it would be necessary to work the machines to or very nearly to maximum capacity. There were in all 11 pumps of eight different makes, these being two American-La France engines of 700 and 1400 gallons capacity a minute, two Nott engines of 600 and 800 gallons, two Robinson engines of 750 and 900 gallons, a Seagrave of 1000 gallons, an Ahrens-Fox of 700 gallons, a Luitwieler of 600 gallons, a Knox of 600 gallons and a Waterous of 700 gallons.

As will be noted from the conditions of the competition the machines were worked for six hours at one pressure, for three hours at a second and for three

The Exhibit of the McNutt Non-Explosive Can Company of Patent Containers for Inflammables and Explosive Fluids.

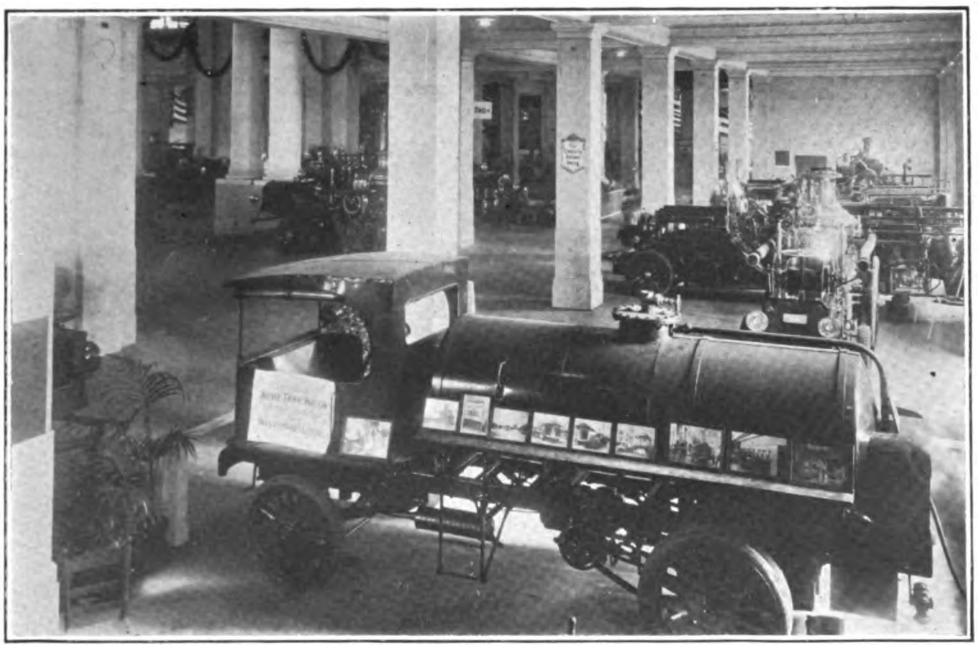
hours at a third pressure, and the official figures show that the Ahrens-Fox and the Waterous pumps were worked the entire 12 hours without any condition arising that was worthy of recording, they having what might be regarded as a perfect score, while the Seagrave pump at the start was 20 minutes getting water because of the necessity of using extra washers to make tight a leaky suction pipe joint. All of the other machines were not in operation the entire periods, as will be shown in the tabulation accompanying the summary.

By reference to the accompanying tabulation it will be seen that the greatest pumpage was by the 1400-gallon American-La France engine, which in 10 hours and 52 minutes discharged 673,416 gallons. The next largest pumpage was by the Seagrave engine, that in 12 hours discharged 542,940 gallons. The third was the Nott 800-gallon engine with 392,716 gallons in 11 hours and 31 minutes, the fourth the Robinson 900-gallon engine with 392,320 gallons in nine hours, the fifth the Robinson 750-gallon engine with 388,615 gallons in 11 hours and 31 minutes, the sixth the Ahrens-Fox 700-gallon engine with 386,520 gallons in 12 hours, the seventh the Waterous 700-gallon engine with 364,440 gallons in 12 hours, the eighth the American-La France 700-gallon engine with 343,695 gallons in 10 hours and 15 minutes, the ninth the Knox 600-gallon engine with 282,818 gallons in 10 hours and 43 minutes, the 10th the Nott 600-gallon engine with 280,135 gallons in eight hours and 55 minutes, and the 11th the Luitwieler 600-gallon engine with 210,408 gallons in seven hours and 44 minutes.

While the total discharge during the period of pumpage can be rated in the order given above it will be understood that this is not the measure that should be made, for the engines were of differing capacities and comparison should be made on the basis of discharge for the actual time of work during each of the three periods, and the average discharge for each hour and for each period contrasted with the rating given by the manufacturer. These figures were not attempted by the committee in charge of the trials, and the original score gave the engine number, the pump pressure, size of nozzle, nozzle pressure, minutes in operation, gallons discharge a minute and each hour. In the compilation in connection with this review these have been grouped to show results for each machine for the entire time of the trials, instead of showing the work of the engines for each hour, which permits easy comparison of the discharge for each hour and the several conditions governing the pumpage.

The tests were conducted under conditions that were ideal in that the weather was clear and the temperature on the pier was high, although somewhat tempered by a light southwest wind, and assumedly the engines were all in condition when they were taken to the pier. Three of the engines were in service 12 hours continuously, the Seagrave 1000-gallon pump, the Ahrens-Fox 700-gallon pump and the Waterous 700-gallon pump.

During the six-hour test the Seagrave pump discharged a maximum of 1060 gallons the second hour and a minimum of 1038 gallons the first hour, and 1049 gallons for the remaining four hours; during the first three-hour period with a rating of 500 gallons the Seagrave pump discharged a minimum of 591 gallons the first hour, 596 the second and 600 gallons the third; during the second three-hour period with a rating of 300 gallons the Seagrave pump discharged 323 gallons the first and second hours and 322 the third. During the six-hour test the Ahrens-Fox pump, with a rating



Section of the Main Floor of the Grand Central Palace, Looking from the Southwest Corner Toward the Main Entrance, Showing Some of the Apparatus Exhibited.

of 700 gallons, discharged a minimum of 706 the first hour, 709 the second, 718 the third, 721 the fourth, 726 the fifth and a maximum of 746 the sixth. During the first three-hour period with a rating of 350 gallons the Ahrens-Fox pump discharged 360 gallons for each hour, and for the second three-hour period with a rating of 330 gallons discharged 343 the first hour, 346 the second and 347 the third. During the six-hour test the Waterous pump, with a rating of 700 gallons, discharged a maximum of 693 gallons the sixth hour and a minimum of 667 gallons the second hour; during the first three-hour period with a rating of 350 gallons the minimum discharge was 352 gallons the first hour and the maximum 359 the third hour; during the second three-hour test with a rating of 300 gallons the maximum was 312 gallons during the first hour and the minimum was 307 gallons the third hour.

The accompanying tabulation gives the detail of the tests for each machine for each successive hour, and the different conditions that developed in connection with the operation of the engines:

No. 1—Seagrave, 1000 Gallons.

Hour	Pump pressure	Size nozzle	Nozzle pressure	Mins. in operation	Gals. a minute	Total discharge
1	123	2.250	47.5	60	1038	62,280
2	126	2.250	49.5	60	1060	63,600
3	124	2.250	48.5	60	1049	62,940
4	126	2.250	48.5	60	1049	62,940
5	126	2.250	48.5	60	1049	62,940
6	125	2.250	48.5	60	1049	62,940
7	200	1.500	78.6	60	591	35,460
8	208	1.500	79.8	60	596	35,760
9	204	1.500	81.0	60	600	36,000
10	255	1.125	74.4	60	323	19,380
11	256	1.125	74.4	60	323	19,380
12	256	1.125	73.8	60	322	19,320

Grand total discharge..........................542,940

Twenty minutes getting water at start on account of leaky suction joint, requiring additional washers to make tight. Tenth hour, slight noise in engine; does not appear serious; no cause was discovered on investigation after test.

No. 2—Ahrens-Fox, 700 Gallons.

Hour	Pump pressure	Size nozzle	Nozzle pressure	Mins. in operation	Gals. a minute	Total discharge
1	125	1.750	60.4	60	706	42,360
2	127	1.750	60.8	60	709	42,540
3	128	1.750	62.3	60	718	43,080
4	128	1.750	62.9	60	721	43,260
5	130	1.750	63.8	60	726	43,560
6	135	1.750	67.4	60	746	44,760
7	209	1.250	61.0	60	360	21,600
8	210	1.250	61.0	60	360	21,600
9	212	1.250	61.0	60	360	21,600
10	258	1.125	84.1	60	343	20,580
11	260	1.125	85.8	60	346	20,760
12	262	1.125	86.0	60	347	20,820

Grand total discharge..........................386,520

No remarks.

No. 3—American-La France, 700 Gallons.

Hour	Pump pressure	Size nozzle	Nozzle pressure	Mins. in operation	Gals. a minute	Total discharge
1	122	1.750	62.0	60	716	42,960
2	124	1.750	60.8	60	709	42,540
3	124	1.750	60.3	60	706	42,360
4	126	1.750	60.3	60	706	42,360
5	126	1.750	61.4	60	712	42,720
6	126	1.750	61.4	60	712	42,720
7	222	1.125	90.0	60	355	21,300
8	222	1.125	90.3	60	355	21,300
9	222	1.125	90.6	60	356	21,360
10	268	1.000	117.5	60	321	19,260
11	267	1.000	117.5	15	321	4,815

Grand total discharge..........................343,695

Engine stopped at 5:20 due to broken fire pump bearings; bearing replaced at 6:11, but engine not started thereafter on account of motor trouble.

No. 4—Luitwieler, 600 Gallons.

Hour	Pump pressure	Size nozzle	Nozzle pressure	Mins. in operation	Gals. a minute	Total discharge
1	120	1.625	40.1	60	497	29,820
2	123	1.625	38.5	60	486	29,160
3	118	1.625	35.0	32	464	14,848
4	122	1.625	48.0	60	543	32,580
5	121	1.625	37.5	60	480	28,800
6	121	1.625	52.9	60	570	34,200
7	198	1.250	45.9	60	313	18,780
8	191	1.250	43.4	50	304	15,200
9	175	1.250	45.0	22	310	6,820

Grand total discharge..........................210,408

First hour valve covers on Nos. 3 and 4 cylinders leaky—started at 6:50; engine working on Nos. 2 and 3 cylinders (ignition trouble); shifted to battery and engine worked O. K. Second hour, radiator steaming badly; carburetor out of adjustment and engine irregular in action; this was adjusted and engine worked O. K. Third hour, engine shut down at 8:54—clutch burned out; clutch set up tight and engine started up at 9:20. Eighth hour, bolt dropped out in cross head; shut down 1:47 to 1:57. Ninth hour, withdrew from test at 2:57; hot bearings.

No. 5—American-La France, 1400 Gallons.

Hour	Pump pressure	Size nozzle	Nozzle pressure	Mins. in operation	Gals. a minute	Total discharge
1	130	2.250	84.7	60	1386	83,160
2	130	2.250	85.2	15	1390	20,850
3	133	2.250	86.7	60	1402	84,120
4	134	2.250	88.3	60	1415	84,900
5	130	2.250	88.8	60	1419	85,140
6	133	2.250	86.7	60	1402	84,120
7	209	1.750	62.5	60	719	43,140
8	209	1.750	65.8	60	736	44,160
9	209	1.750	67.8	60	748	44,880
10	265	1.625	61.2	37	613	22,686
11	269	1.625	65.7	60	635	38,100
12	269	1.625	65.9	60	636	38,160

Grand total discharge..........................673,416

Second hour, stopped 8:35, air dome cracked; 9:05 run resumed with borrowed air dome. Tenth hour, No. 2 inlet valve spring broken and engine shut down 4:20; replaced and started again at 4:43.

No. 6—Knox, 600 Gallons.

Hour	Pump pressure	Size nozzle	Nozzle pressure	Mins. in operation	Gals. a minute	Total discharge
1	126	1.625	57.9	60	596	35,760
2	126	1.625	57.8	60	595	35,700
3	114	1.625	52.2	43	566	24,338
4	67	1.625	28.5	60	419	25,140
5	68	1.625	28.8	60	420	25,200
6	68	1.625	28.5	60	419	25,140
7	...	....	...	..	...	.....
8	231	1.625	24.7	60	390	23,400
9	232	1.625	25.0	60	392	23,520
10	261	1.500	28.3	60	355	21,300
11	263	1.500	29.0	60	359	21,540
12	262	1.500	29.6	60	363	21,780

Grand total discharge..........................282,818

Third hour, 9:00, pump plunger sleeve lugs broke; shut down 15 minutes. Seventh hour, 12:30-1:55, shut down for repairs to pump sleeve lugs.

No. 7—Nott, 600 Gallons.

Hour	Pump pressure	Size nozzle	Nozzle pressure	Mins. in operation	Gals. a minute	Total discharge
1	129	1.625	63.5	60	625	37,500
2	130	1.625	63.5	60	625	37,500
3	133	1.625	65.0	60	632	37,920
4	130	1.625	65.3	60	633	37,980
5	129	1.625	64.7	60	630	37,800
6	128	1.625	64.0	60	631	37,860
7	203	1.250	44.6	60	308	18,480
8	206	1.250	44.9	60	309	18,540
9	194	1.250	42.6	55	301	16,555

Grand total discharge..........................280,135

First hour, valve rocker arm pin loose 7:45; missing fire occasionally at 7:45; O. K. at 8:00. Ninth hour, cylinder gasket in No. 2 leaked, allowing water in cylinder; engine stopped at 4:00.

No. 8—Robinson, 750 Gallons.

Hour	Pump pressure	Size nozzle	Nozzle pressure	Mins. in operation	Gals. a minute	Total discharge
1	127	2.000	42.0	60	770	46,200
2	127	2.000	42.6	27	775	25,575
3	123	2.000	42.3	60	773	46,380
4	124	2.000	44.5	60	793	47,580
5	125	2.000	45.0	60	797	47,820
6	128	2.000	45.1	60	798	47,880
7	209	1.375	56.4	60	420	25,200
8	216	1.375	54.0	60	412	24,720
9	217	1.375	55.0	60	416	24,960
10	246	1.000	110.0	60	310	18,600
11	237	1.000	10.0?	60	295	17,700
12	192	1.000	81.4	60	267	16,020

Grand total discharge..........................388,635

First hour, engine shut down 6:50 to 6:52 to replace bolt on end of fire pump connecting rod. Second hour, engine stopped 8:27 account of tight bearing; plenty of oil used and engine started up 9:00. Third hour, 9:15, pump bearings heated; cooled by application of water until 9:35; motor missing from 9:17 to 9:25. Ninth hour, pump bearings cooled by application of water at 4:15. Tenth

hour, 4:25 to end of test, pump operating poorly, owing to defective suction valves.

No. 9—Nott, 800 Gallons.

1	128	2.000	47.9	60	823	49,380
2	129.2	2.000	48.2	46	826	37,996
3	133	2.000	50.4	45	844	37,980
4	133	2.000	50.0	60	841	50,460
5	132	2.000	50.1	60	842	50,520
6	132	2.000	50.0	60	841	50,460
7	189	1.375	49.8	60	395	23,700
8	184	1.375	49.3	60	393	23,580
9	182	1.375	49.3	60	393	23,580
10	248	1.125	45.0	60	251	15,060
11	250	1.125	45.0	60	251	15,060
12	249	1.125	44.3	60	249	14,940

Grand total discharge........................392,716

First hour, valve rocker arm bolts loose on Nos. 5 and 6 cylinders 7:45; engine continued in operation. Second hour, missing on No. 4 cylinder; inlet valve spring broken at 8:00; shut down at 8:16 to replace and started up at 8:45. Third hour, riveted rocker arm pins to prevent loosening, while engine was in operation. Fifth hour, valve rocker arm bolts loose on cylinders Nos. 3 and 4; broke valve rod yoke on No. 3 cylinder at 11:20; this was replaced during first shift of hose at 12:30. Ninth hour, inlet valve springs on Nos. 1 and 2 cylinders broken just before 3:45.

No. 10—Robinson, 900 Gallons.

1	124	2.000	56.2	60	891	53,560
2	127	2.000	57.3	60	899	53,940
3	129	2.000	57.6	60	902	54,120
4	116	2.000	50.3	60	843	50,580
5	111	2.000	48.3	60	827	49,620
6	111	2.000	48.3	60	827	49,620
7	211	1.375	64.0	60	448	26,880
8	212	1.375	64.1	60	448	26,880
9	216	1.375	65.1	60	452	27,120

Grand total discharge........................392,320

Second hour, water from radiator cap was blown by fan against spark plug, so belt was taken off. Fourth hour, No. 6 cylinder missing at 9:50; operator said cylinder was cracked; occasionally No. 6 cylinder would operate. Seventh hour, No. 2 inlet and No. 6 exhaust valve springs broken. Eighth hour, 2:00, No. 6 inlet valve spring broken. Ninth hour, 2:25 till time of shut down (4:57) plunger packing leaked. Tenth hour, engine shut down at 4:57 account pump trouble, caused by leaky valves.

No. 11—Waterous, 700 Gallons.

1	123	1.750	55.4	60	678	40,680
2	119	1.750	53.8	60	667	40,020
3	124	1.750	55.8	60	678	40,680
4	124	1.750	56.4	60	682	40,920
5	126	1.750	56.4	60	682	40,920
6	127	1.750	58.1	60	693	41,580
7	216	1.125	88.6	60	352	21,120
8	217	1.125	90.1	60	355	21,300
9	220	1.125	91.7	60	359	21,540
10	261	1.000	111.1	60	312	18,720
11	257	1.000	109.0	60	309	18,540
12	258	1.000	107.7	60	307	18,420

Grand total discharge........................364,440

First hour, engine varying in speed, missing occasionally; carburetor popping, due probably to air in gasoline line; settled down to good action in about two hours.

The specifications and ratings of the engines, as prepared by the committees, showed the following detail:

No. 1—Seagrave pumping engine, rated at 1000 gallons at 120 pounds pressure, 500 at 200, and 300 at 250. Net weight, without men or hose, 16,370 pounds; tires, solid, five-inch single forward, four-inch dual rear; tread, 68 inches; wheelbase, 14 feet four inches. Engine, own make, six-cylinder, 7.75-inch bore, nine-inch stroke, 144 horsepower. Gear ratio, engine to pump, 1:3.6. Centrifugal pump, three-stage, 11-inch impeller. One gasoline tank, 60 gallons. Height of pump from ground, 43 inches.

No. 2—Ahrens-Fox pump with hose body, rated at 700 gallons at 120 pounds, 350 at 200 and 330 at 250. Net weight, 14,520 pounds; tires, solid, six-inch single forward, four-inch dual rear; tread, 66 inches; wheelbase, 12 feet four inches. Engine, Herschel-Spillman, built to plans of Ahrens-Fox Fire Engine Company, six-cylinder, 5.75-inch bore, 6.5-inch stroke; 79.3 horsepower. Gear ratio, engine to pump, 3.11:1 and 4.33:1. Pump, two-cylinder, double-acting, steamer type; 6.5-inch bore, four-inch stroke. One gasoline tank, 45 gallons. Height of pump above ground, 45 inches.

No. 3—American-La France, triple combination, rated at 700 gallons at 120 pounds, 350 at 200 and 325 at 250. Net weight, 8925 pounds; rear wheels, 5395 pounds; tires, Dayton airless, 4.5-inch single forward, 4.5-inch dual rear; tread, 62 inches; wheelbase, 13 feet two inches. Engine, own make, six-cylinder, 5.5-inch bore, six-inch stroke, 72.6 horsepower. Gear ratio, engine to pump, 1.66:1 and 3:1. Pump, rotary gear; displacement, 1.25 gallons a revolution. Two gasoline tanks, 11 and 28 gallons. Height of suction, 33 inches.

No. 4—Luitwieler, combination pumping engine and hose wagon, rated at 600 gallons at 120 pounds, 300 at 200 and 200 at 250. Net weight, 10,200 pounds; rear wheels, 6200 pounds; tires, solid, four-inch single forward, five-inch single rear; tread, 58 inches; wheelbase, 11 feet seven inches. Engine Trebert, four-cylinder, six-inch bore, 6.5-inch stroke, 57.6 horsepower. Gear ratio, engine to pump, 11.78:1, 24.79:1 and 36.14:1. Pump, three-cylinder, double-acting, six-inch bore, 12-inch stroke, displacement, 8.581 gallons a revolution. One gasoline tank, 30 gallons. Height of suction, 25 inches.

No. 5—American-La France combination pumping engine and hose wagon, rated at 1400 gallons at 120 pounds, 700 at 200 and 640 at 250. Net weight, 12,770 pounds; rear wheels, 6760 pounds; tires, solid, five-inch single forward, five-inch dual rear; tread, 63 inches; wheelbase, 14 feet six inches. Engine, own make, six-cylinder, 7.125-inch bore, eight-inch stroke, 126.2 horsepower. Gear ratio, engine to pump, 2.15:1 and 4:1. Pump, rotary gear; displacement, four gallons a revolution. Two gasoline tanks, 28 and 15 gallons. Height of suction, 36 inches.

No. 6—Knox combination pumping engine and hose wagon, rated at 600 gallons at 140 pounds, 400 at 200 and 325 at 250. Net weight, 14,010 pounds; rear wheels, 7330; tires, solid, five-inch single forward, five-inch dual rear; tread, 70 inches; wheelbase, 14 feet four inches. Engine, own make, six-cylinder, five-inch bore, six-inch stroke, 60 horsepower. Gear ratio, engine to pump, 6.47:1 and 3.77:1. Pump, two-cylinder, double-acting; five-inch bore, eight-inch stroke. One gasoline tank, 30 gallons. Height of suction, 32.5 inches.

No. 7—Nott combination engine and hose wagon, rated at 600 gallons at 120 pounds, 300 at 200 and 250 at 250. Net weight, 12,300 pounds; rear wheels, 6600 pounds; tires, solid, five-inch single forward, six-inch single rear; tread, 71 inches; wheelbase, 11 feet 8.5 inches. Engine, own make, four-cylinder, 6.5-inch bore, eight-inch stroke, 67.6 horsepower. Gear ratio, engine to pump, 1.2:1. Pump, rotary roller, dual or single-acting; displacement, .98 gallon a revolution. One gasoline tank, 40 gallons. Height of suction, 46.5 inches.

No. 8—Robinson, combination pumping engine and hose wagon, rated at 750 gallons at 120 pounds, 400 at 200 and 300 at 250. Net weight, 11,600 pounds; rear wheels, 6160 pounds; tires, solid, five-inch single forward, six-inch single rear; tread, 60.5 inches; wheelbase, 14 feet four inches. Engine, Buffalo Gasoline Motor Company's, six-cylinder, 6.25-inch bore, 6.75-inch stroke, 93.7 horsepower. Gear ratio, engine to pump, 3:1. Pump, three-cylinder, single-acting; six-inch bore, eight-inch stroke; displacement, 2.938 gallons a revolution. One gasoline tank, 30 gallons. Height of suction, 39.5 inches.

No. 9—Nott combination pumping engine and hose wagon, rated at 800 gallons at 120 pounds, 400 at 200 and 360 at 250. Net weight, 14,360 pounds; rear wheels, 8150 pounds; tires, solid, six-inch single forward, five-inch dual rear; tread, 71 inches; wheelbase, 11 feet 8.5 inches. Engine, own make, six-cylinder, 6.5-inch bore, eight-inch stroke, 101.4 horsepower. Gear ratio, engine to pump, 1.3:1. Pump, rotary roller, dual or single-acting; displacement, 2.63 gallons a revolution. One gasoline tank, 40 gallons. Height of suction, 46.5 inches.

No. 10—Robinson combination pumping engine and hose wagon, rated at 900 gallnos at 120 pounds, 500 at 200 and 350 at 250. Net weight, 11,150 pounds; rear wheels, 5890 pounds; tires, solid, five-inch single forward, six-inch single rear; tread, 60 inches; wheelbase, 14 feet five inches. Engine, Buffalo Gasoline Motor Company's, six-cylinder, 6.25-inch bore, 6.75-inch stroke, 93.7 horsepower. Gear ratio, engine to pump, 2.5:1 and 3.75:1. Pump, three-cylinder, single-acting, six-inch bore, eight-inch stroke; displacement, 2.938 gallons a revolution. One gasoline tank, 30 gallons. Height of suction, 37.75 inches.

No. 11—Waterous combination pumping engine and hose wagon, rated at 900 gallons at 120 pounds, 500 at 200 and 350 at 250. Net weight, 13,830 pounds; rear wheels, 9060 pounds; tires, solid, five-inch single forward, four-inch dual rear; tread, 69 inches; wheelbase, 11 feet four inches. Engine, own make, six-cylinder, 6.5-inch bore, seven-inch stroke, 101.4 horsepower. Gear ratio, engine to pump, 2.23:1. Pump, four-cylinder, single-acting, 4.75-inch bore, eight-inch stroke; displacement, 2.455 gallons a revolution. Two gasoline tanks, 20 gallons. Height of suction, 23.25 inches.

The examination of the machines at the conclusion of the test showed that all the bearings, pistons, cylinders, valves, etc., were in good condition except the following: No. 4, no inspection, as machine was withdrawn from the test; 7, gasket leaks on No. 2 cylinder, nut gone from one valve rocker arm bolt; 8, Nos. 2 and 3 connecting rods each had loose check nuts on cap bolts, could not come off on account of cotter pins ("holding" nuts tight); 9, one valve rocker arm bolt broken, three valve rocker arm bolts loose, nuts and washers missing, two inlet valve

springs broken; 10, leak from water jacket into No. 6 cylinder, allowing water to enter cylinder and crankcase; three valve springs broken.

The following tabulation shows the total time each machine was in service, the maximum and minimum suction lift and the amount of gasoline used:

	Time		Max. Lift		Min. Lift		Fuel
No.	Hrs.	Mins.	Ft.	In.	Ft.	In.	Gals.
1	12	0	14	1	8	7	219
2	12	0	14	3	8	9	117
3	10	15	13	3	7	9	108
4	7	34	12	7	7	1	56.75
5	10	52	13	6	8	0	255
6	10	43	13	2	7	8	102
7	8	55	14	4	8	10	106
8	11	27	13	9	8	3	144
9	11	31	14	4	8	10	159
10	9	0	13	8	8	2	100
11	12	0	12	6	7	0	148

It is expected that the work of the machines will be carefully analyzed by the engineers of the National Board of Fire Underwriters, and the information will be placed at the disposal of the different insurance companies.

The exhibition of fire department apparatus consisted of displays of about 50 different pieces of equipment, some of which were shown in the main floor of the Grand Central Palace and some in the streets, while some of the exhibits were seen both in the building and in different parts of the city. There were in all 14 exhibitors, these including the Ahrens-Fox Fire Engine Company, Cincinnati, O.; American & British Manufacturing Company, Providence, R. I.; American-La France Fire Engine Company, Elmira, N. Y.; James Boyd & Bro., Inc., Philadelphia, Penn.; Front Drive Motor Company, Hoboken, N. J.; International Motors Company, New York City; Knox Automobile Company, Springfield, Mass.; Luitwieler Pumping Engine Company, Rochester, N. Y.; Martin Carriage Works, York, Penn.; Nott Fire Engine Company, Minneapolis, Minn.; Pope Manufacturing Company, Hartford, Conn.; Robinson Fire Apparatus Manufacturing Company, St. Louis, Mo.; Seagrave Company, Columbus, O.; Waterous Engine Works Company, Minneapolis, Minn.

The exhibits were as follows:

Ahrens-Fox Fire Engine Company, model A pump and hose carrier, six-cylinder, 80 horsepower motor, two-cylinder double-acting piston pump, with hose capacity of 1200-1500 feet; model D combination hose and chemical wagon with auxiliary or "booster" pump.

American & British Manufacturing Company, two gasoline-electric two-wheel tractors (Hoadley system) attached to steam pumps of the improved Amoskeag type.

American-La France Fire Engine Company, 65-foot aerial ladder truck, two 75-foot aerial ladder trucks; type 10 combination hose and chemical wagon; type 12 combination fire pump, chemical and hose wagon; type 14 city service ladder truck and chemical engine, two chemical and hose wagons; type 15 fire pump, one six-cylinder 100 horsepower tractor and steam fire pump; type 12 triple combination fire pump, chemical and hose wagon, with six-cylinder, 70 horsepower motor; type 15 combination fire pump and hose wagon with six-cylinder, 126 horsepower motor; steam chemical and hose wagon built in 1902 for the New London, Conn., fire department.

James Boyd & Bro., combination hose and chemical wagon on a White chassis; Boyd four-cylinder, 60 horsepower combination hose and chemical wagon on a Boyd chassis, and display of parts of which the Boyd machines are constructed.

Front Drive Motor Company, Christie front-wheel driven tractor and steam fire pump.

International Motor Company, Mack tractor attached to hand ladder truck, hose wagon with turret nozzle, hose wagon, combination hose and chemical wagon.

Knox Automobile Company, three Knox combination fire pumps and hose wagons, Knox triple combination fire pump, hose and chemical wagon; Knox piston fire pump, Martin tractor, Martin tractor coupled to a steam fire pump loaned by the Springfield, Mass., fire department, Martin tractor coupled to steam fire pump and a Martin tractor coupled to a 75-foot aerial ladder, the last two being demonstrated in the streets.

Luitwieler Pumping Engine Company, combination fire pump and hose wagon with 57 horsepower, four-cylinder motor.

Martin Carriage Works, combination chemical and hose wagon.

Nott Fire Engine Company, two four-cylinder, 67 horsepower motor fire pumps, one six-cylinder, 101 horsepower motor fire pump.

Pope Manufacturing Company, one shaft-driven combination hose and chemical wagon, one chain driven combination hose and chemical wagon.

Robinson Fire Apparatus Manufacturing Company, combination fire pump and hose wagon with six-cylinder, 93 horsepower motor, having capacity of 750 gallons a minute; combination fire pump and hose wagon with six-cylinder, 93 horsepower motor, having capacity of 900 gallons a minute.

Seagrave Company, 75-foot aerial ladder truck with six-cylinder, 80 horsepower motor tractor, combination hose and chemical wagon with four-cylinder, 53 horsepower motor, 1000-gallon centrifugal fire pump with 144 horsepower, six-cylinder motor, combination city service apparatus with six-cylinder, 80 horsepower motor.

Waterous Engine Works Company, combination fire pump and hose wagon with six-cylinder, 101 horsepower motor.

Turning to these exhibits it may be stated that there were a number that were shown for the first time, though the general policy of the manufacturers of fire apparatus is to begin the marketing of a production immediately upon its completion. The exhibition was the largest ever seen in the world, and the machines represented the greatest advance ever made in the building of fire protective equipment.

The earliest gasoline motor propelled apparatus was the converted pleasure car chassis, or chassis for such cars, adapted to such requirements as could be anticipated without knowledge from experience. These were utilized for quick work, the transportation of departmental officers, for chemical engine and for hose wagons, and then came the endeavor to construct fire pumps that could be driven by the vehicle motors. Most of the fire pumps have been developed along the lines of automobiles, just as freight motor wagons have been developed from pleasure vehicle construction, but with the realization that many of the towns and cities have thoroughly dependable steam fire pumps and horse drawn ladder trucks and from economical reasons do not desire to sacrifice these, although wanting the greater speed possible with the motor apparatus, some of the manufacturers have turned to the building of tractors with which the steam pumps and horse trucks may be converted so as to have the utility and the practicality of equipment motor propelled.

In this connection it may be well to point out that the American & British Manufacturing Company, the American-La France Fire Engine Company, Front Drive Motor Company, Knox Automobile Company, International Motor Company and the Seagrave Company have developed tractors, which were exhibited, and of these the American & British and the Front Drive Motor machines are front wheel driven, and the others are the four-wheel type, these being driven by the rear wheels as in conventional motor vehicle practise.

There is no doubt whatever that tractors have attracted a great deal of attention from fire department engineers and municipal officials, and this from the fact

that not only are they economical through the conversion of horse apparatus, but also through the possibility of having the thoroughly dependable steam pumps, which are regarded by many as being at least the equal of any of the gasoline motor pumps. Whatever the relative qualities and merits of the two forms of pumps may be there is no doubt that the judgment of those purchasing must determine that which appears best suited for the needs, and while there are many who believe that the gasoline motor pump is still experimental, this being particularly of large cities, the practicability of the tractor and the steam pump is unquestioned.

The disposition of many leading fire engineers is to make experiment with both tractors and motor fire pumps, but to make no sweeping changes until continued experiment has proven the reliability of the gasoline pumping engine from the viewpoint of those considering its use. This condition has brought a number of fire apparatus manufacturers to the production of tractors, and of the 14 exhibitors six of them build them commercially. Two of these, the A-B (American & British) and the Christie, are the two-wheel type and when attached make the conventional four-wheel equipment. The American-La France, Martin, Mack and Seagrave are the self-supported type and these, save the Martin, which has one forward wheel, when used make the apparatus six-wheeled, and consequently longer than either the A-B or the Christie.

One of the claims made for the four-wheeled apparatus using the non-self-supporting tractor is the greater ease of handling in narrow streets and congested traffic, because of the well known possibilities with vehicles of short wheelbase, as well as the faster time that can be made in traffic where turns are frequent. But some of the makers of the four-wheel tractors maintain that with them 75-foot ladders may be turned in 30-foot streets; that they meet with practically all of the requirements for fire department purposes. Whether or not the desired qualities may be realized is for the chiefs of the fire departments to decide—the purpose of this review is to establish the fact that the fire apparatus manufacturers have realized the need of tractors for the heavy equipment and have sought to supply the demand. Of these the Martin has been built for several years and there are now about 150 machines of this kind in use, it having been standardized, and having been worked out in many freight installations as well as in fire department equipment. It is the oldest and best known of the tractors seen at the exhibition.

The Christie tractor has been built for about two years, the first being placed in the service of the New York City department, Dec. 1, 1911, and since that time something more than 100 have been built. The first Christie tractors were constructed with a turntable so that after the wheels had been turned 30 degrees by a movement of the gear changing lever the driving movement of the engine was changed from the front wheels to the turntable, so that the wheels could be turned to an angle of 90 degrees, by moving the turntable 60 degrees. Having reached this point the changing of the lever would cause the power to be applied to the front wheels and the machine could be driven forward. The turntable and the attendant complications have been eliminated and the wheels are now turned in the same radius as in any standard automobile design. Aside from this the tractor has been continued unchanged. The motor is placed transversely in the chassis and the drive is from a gearset affording high and low speeds and reverse through a chain to a counter or cross shaft having universal joints at the ends, and attached to the ends of the shafts are spur pinions that mesh with large internal gears mounted on the wheels. The universal joints in the cross shaft are directly above the steering pivots of the axle.

The American & British, known as the Hoadley system, shown for the first time, was the gasoline-electric, although the same method of driving may be utilized with a standard electric battery that may be charged as frequently as desired. This tractor consits of a short chassis that is mounted on two wheels, that carries the power plant and driving mechanism, and to the rear of this the engine, truck or cart may be attached. The chassis frame carries the four-cylinder, water-cooled, British-American motor, to which is directly coupled the generator. The capacity of the generator is dependent on engine speed and it may be varied to meet any requirement. The chassis is carried on two semi-elliptic springs and these are mounted on a truss axle, the upper and lower members being held by two cross members bolted to them.

Pivoted between the ends of the upper and lower axle members are mounted two 4.5-horsepower General Electric motors, enclosed in steel frames or shells. These are carried on Timken roller bearings. The armature shaft of the motor extends at either end and carries a bevel gear. These bevel gears mesh with two other bevel gears on cross shafts mounted in the extensions of the motor housing, and on the ends of these cross shafts are spur pinions that mesh with a large internal gear attached to the wheels. The cross shaft gears are mounted, the one at the inside and the other at the outside end of the cross shaft so that the spur pinions are driven in the same direction.

The outside of the motor frame carries the wheel spindle and on this the wheel is mounted. The wheel and the motor turn on the pivot between the axle members and are actuated by a conventional steering linkage and hand wheel. The motor frame is sectional, so that the ends may be removed to afford access to the bevel gears and cross shafts, or to reach the armature bearings and the motor brushes. The internal gear of the wheel is protected by a telescoping housing, so that all the moving parts are shielded from water, dust, etc. The wheels are of large size and the tires are a band type. The motor has the usual equipment and auxiliaries of the gasoline installation, with a sufficient radiating system to insure against heating when

driven for a long time continuously. The first machines were produced for use with steam fire pumps carried on large wheels with a brake of the locomotive type on the rear wheels, but those now building are fitted with a service brake on the driving wheels and an emergency brake of the locomotive type on the rear wheels. The gradation of the power as applied for driving purposes is through the engine variations, but there is also a three point controller that affords two forward speeds and reverse, and there is the possibility of the use of these with the variance of the engine, so there is a very wide difference of speed of the tractor.

The American-La France, Mack and Seagrave tractors are conventional four-wheel types, driven by gasoline motors. The American-La France tractor is designed so that horse apparatus may be converted without withdrawal from service, and it is propelled by a six-cylinder, water-cooled motor of 100 horsepower, the drive being by shaft, jackshaft and side chains to the rear wheels. The rear end of the chassis carries a circular frame on which the "fifth wheel" of the truck is installed and secured, this permitting the tractor to be swung in either direction 90 degrees. The wheelbase is 156.75 inches. The Mack tractor is practically the same in general design, but the turntable at the rear is a large ring into which a cup-shaped ring is fitted, and the latter carries the forward end of the ladder truck or steam pump frame. Should there be inequality of road surface the cup-shaped ring will move in its support without causing a strain upon the chassis or the frame it carries, there being much the same action as might be expected from a universal joint. This movement of either part of the equipment is allowed independently and a variation of 15 degrees in each can be compensated.

The Seagrave tractor is built with either a four or six-cylinder motor and it also carries at the rear of the chassis a turntable which has a rocker plate to compensate for inequalities in the road surface. It is maintained for this that it is practical to convert these machines into combination hose and chemical wagons by the removal of the turntable and the installation of a body and chemical tank. The motors are either 50 or 80 horsepower.

The American-La France is building a two-wheel tractor that can be used for the same purposes as the American-British or the Christie, but this is gasoline motor driven and the special characteristic of this is a truss front axle with a series of cross members. Mounted at either end of the axle is a short shaft. Near the inner end of the shaft is a sprocket. The outer end of the shaft carries a bevel gear. Pivoted between the ends of the upper and lower axle members on Timken bearings is a heavy bronze housing, square in form and approximately eight inches depth. This housing will swing 39 degrees. Mounted between the ends of the axle members, within the housing is a vertical shaft, on which are carried at either end a bevel pinion. The upper pinion meshes with the bevel gear on the outer end of the horizontal shaft in the axle, and the lower pinion meshes with a bevel gear on the end of the axle spindle carried in the square housing.

The two axle shafts are driven by chains and these turn the vertical shafts and the axle spindle through the two pinions on the vertical shaft in the square housing, and this action is continued with no greater loss of power, no matter what the angle of the wheel. This is an adaptation of the drive used in the Krieger electric carriages in France, and which has been adopted by the Panhard-Levassor heavy vehicles in France. In the American-La France tractor, however, the vertical shaft and the bevel gears and pinions are enclosed in a telescoping housing that is grease and water tight, and which protects it against wear and abrasion. The first of these tractors and the axle construction were shown in connection with the exhibition of this company, but there was no demonstration. The tractor is built with a view to utilizing it for the conversion of horse steam fire pumps and trucks.

A decided novelty in a fire pump was shown by the Luitwieler Pumping Engine Company, in which automobile practise is departed from and an endeavor sought to construct what will afford the greatest capacity and eliminate what are considered by the designer as inherent faults in automobile construction. This is a combination engine and hose carrier and is the first machine produced. It is the intention of the company to build these in 600 and 750-gallon capacities and to build pumping engines with capacities of 850 and 1000 gallons, as well as smaller combination hose and chemical wagons and fire pumps of 250 gallons capacity, both with and without hose.

In this machine the motor is installed directly above the rear axle and the radiator is behind the motor to protect it. The engine cranks from the rear and the cone clutch is between the engine and the jackshaft. The ends of the jackshaft are above the chassis frame and the transmission gearset is in combination with the jackshaft, but is transverse in the frame. The gearset is a sliding type, affording three ratios of speed. The jackshaft consists of a shaft on which is a sleeve, and this sleeve carries the gears of the gearset. The shaft has at its outer ends the driving sprockets, from which chains extend to the rear wheels.

Forward of the jackshaft is installed the cam-actuated, three-cylinder piston pump, and this is driven by a chain from the jackshaft. The gearset may be used to give three speed ratios for driving the machine or for operating the pump, there being two clutches so that for driving the jackshaft and sleeve are coupled, but for pumping the driving is through the sleeve alone, and the change can be made by moving a lever that is independent of the customary gear changing system. The possibilities with the change of speeds for pumpage is seen when it is understood that the high ratio gives full pump capacity at 120 pounds pressure, the intermediate 240 pounds at half capacity, and 400 pounds at quarter capacity, this making it possible to force streams through long lines of hose.

The machine is driven by a Trebert motor having 57.6 horsepower, a 2.5-inch crankshaft, with five main bearings having a total length of 20.75 inches. The bore is six inches and the stroke 6.5 inches. All working parts of the motor are enclosed. The weight of the engine is 10,200 pounds and it is claimed that the weight is evenly distributed on all four wheels, this lessening the skidding and equalizing the stresses upon the machine, and permitting the use of four-inch tires forward and five-inch tires at the rear. The wheelbase is 139 inches, and with the engine carried over a platform spring and the elimination of the throw of the water pump the strains upon the construction are minimized. The seat for the driver is upon the top of the water pump cylinders. The control is conventional and the searchlight is constructed to turn with the wheels, this always lighting the street or road ahead of the engine. Under the chassis is a supplementary or auxiliary radiator that may be used in the event of long runs. Above the engine and pump mechanism is a hose bed or tray 10 feet long, and by the use of curtains the entire machinery may be enclosed in cold weather. There are many ingenious devices incorporated in the apparatus, such as for priming the cylinder from the main fuel tank, for cooling the cylinders by a direct supply of water from the pump, for cutting out the radiator and cooling from the pump when necessary, of cooling the exhaust pipe by water, for utilizing the auxiliary radiator, and for pivoting the cross spring of the rear platform to minimize chassis strains from road inequalities. The main radiator is a sectional type from which a section may be taken at will and the use of the cooler continued. The engine is open in the chassis and is not covered, so that every part is accessible and is under the eye of the operator. One very interesting device is that by which the pump pressure may be varied instantly, this being done by a hand lever that affords seven changes.

One of the features of the Ahrens-Fox "Scout," a combination chemical-hose wagon, is an auxiliary pump of 50 gallons a minute capacity that is carried forward of the radiator and driven from an extension of the engine shaft. To this pump a line of hose may be coupled and the water may be pumped from this through the hose used for discharging the chemical solution in the tank. The machine can be connected with a hydrant and should the chemical in the tank be sufficient more water need not be used, but should this be exhausted the pump will force water through the chemical hose from the hydrant, and by use of a patent nozzle two sizes of stream can be used. The hose is carried on a reel beneath the seat and is concealed, but it is always connected and it can be drawn out or reeled and utilized instantly, the water or chemical flowing through the hose whenever desired by the firemen. In the event of no hydrant supply of water the tank can be filled by buckets and the water drawn from that by the pump.

The Waterous Engine Works Company showed a combination pump and hose wagon of conventional design, having a six-cylinder motor of 101 horsepower, fitted with a four-cylinder, single-acting pump, having a capacity of 700 gallons at 120 pounds pressure.

The Nott Fire Engine Company exhibited three machines, two of the combination engine and hose wagon type with four-cylinder motor having 67.6 horsepower equipped with a rotary roller pump, either dual or single-acting, and one with a six-cylinder motor having 101 horsepower and fitted with a similar pump. One of the four-cylinder pumps had been driven upwards of 2000 miles, making demonstrations in different cities from the Middle West to New England.

The Boyd machines were of conventional type, as were the Pope-Hartford combination wagons, while the Knox engines were the standard productions of the Knox Automobile Company. The Martin Carriage Works combination hose and chemical wagon was an excellent machine and was admirably equipped. The hose wagons built by the International Motor Company were standard types.

All of the machines shown were of excellent design and were generally approved by the firemen, and of these it was noticeable that only the Boyd productions were fitted with electric engine starters. There has been no apparent inclination of apparatus builders to install engine starters, there being an apparent belief that these are not necessary where the machines are kept in quarters and protected, while many maintain that starters add to the complications and require additional care, to say nothing of the possibility of being affected by the water during a fire.

The desirability of electric lighting is questionable in the minds of many of the fire chiefs in view of the additional equipment and the possibility of failure because of the condition under which such apparatus is used. The standard equipment for machine is gas lamps, the fuel being supplied from tanks.

In the accessory division of the exhibition the majority of the manufacturers of rubber products, even the tire makers, showed fire hose, and there was but little attention given to displays of tires. The New Departure Manufacturing Company, Bristol, Conn., had an exhibit of electric and hand operated bell equipment for fire apparatus that attracted much attention. The McNutt Non-Explosive Company exhibited a great variety of containers for storing gasoline and other fluid of an inflammable character. The Martini & Huneke Company of America displayed a new type of gasoline storage apparatus suited for garage purposes, which may be adapted to tank wagons and the same protection given to the delivery of fuel as is afforded by the stationary installations. There was also a display of gasoline storage equipment made by S. F. Bowser & Co., Inc. The Pyrene Company of America showed its well known line of fire extinguishers for vehicle and general purposes, and very large exhibits were made by the Timken Roller Bearing Company and the Timken-Detroit Axle Company, these including roller bearings and different forms of axles suited

for fire apparatus construction. The Sheldon Axle Company's display was of front and rear axles, transmission gearsets, worm driven rear axles, wood and steel wheels, springs and other parts produced by this concern. Some of these productions, especially the worm driven axles, are new and were seen for the first time. The spring display was of all forms adaptable for fire department service. The Sewell Wheel Company, Detroit, Mich., exhibited and demonstrated its well known types of cushion wheels for light and heavy vehicles. The remainder of the exhibition was made up of fire protective and life saving equipment, ladders, fire extinguishers, and the like. These exhibits came in for much attention.

The firemen at the closing session of the convention elected the following officers: President, Thomas Hanley, Jacksonville, Fla.; first vice president, Hugo Leiphs, Lansing, Mich.; second vice president, Harry Marston, Brockton, Mass.; secretary, James McFall, Roanoke, Va.; treasurer, George Knofflock, Mansfield, O. The next session of the association will be held at New Orleans, La.

At Philadelphia, Penn., the Diamond-Keystone Supply & Transportation Company has been organized for the purpose of transporting produce from farms within a reasonable distance of Philadelphia to that city, and hauling supplies of all kinds from Philadelphia to the farmers. Much of this work is now done by the railroads and it is believed that the haulage can be profitably done with machines at prices less than are now paid, and by prompt and regular daily deliveries better serve the market.

The Toledo Carriage Woodwork Company, Toledo, O., has begun the manufacture of a 1500-pound delivery wagon which will be marketed under the name of Trojan. The machine has a unit power plant installed beneath the floor and the drive is by bevel gear through a floating rear axle.

FORD BUYS KELLY TRUCKS.

Four Three-Ton Machines Now in Use at the Big Manufactory at Detroit.

The Kelly-Springfield Motor Truck Company, Springfield, O., has just delivered to the Ford Motor Company at Detroit, Mich., two three-ton Kelly trucks, which will be used in the haulage of materials and supplies in and about Detroit. The plant of the Ford Motor Company is one of the largest in the industry and it is credited with a capacity and facilities for producing more than 1000 Ford pleasure cars daily under favorable conditions for operation, but this is not the average daily output. In fact, so far as known, there has been no definite statement made by the company as to the number built, either maximum, minimum or average.

The Ford chassis, when fitted with bodies, may be serviceable for some forms of haulage, but they have not sufficient capacity to make them preferable to machines of greater size, and to utilize them would necessitate the employment of a driver at least for each. In other words, when considering the uses, it would require five Ford chassis and five drivers to do the work done by one driver and a 3000-pound truck. Thus the saving in drivers' wages is an item of large importance, and were all else equal the truck would be preferable. The company first purchased two Kelly trucks and after using them in all kinds of haulage it added two more. The accompanying illustration shows some of the machines in the factory work.

Two of the Four Kelly Three-Ton Trucks Utilized in General Haulage at the Plant of the Ford Motor Company, Detroit, Mich.

The Ingalls Lumber Company, New Haven, Conn., has a four-ton Kissel truck in service that is, according to L. S. Ingalls of the company, doing the work for which 17 horses were formerly used. The truck is driven three round trips a day, covering 20 miles a trip, carrying 60 railroad ties, and a four-horse truck can make but one trip, carrying 50 ties, and can work but five days a week.

The Tiffany Electric Company, which was recently organized at Pontiac, Mich., by E. L. Pelletier and others, to build electric vehicles, will begin the manufacture of a 1000-pound delivery wagon about Oct. 15.

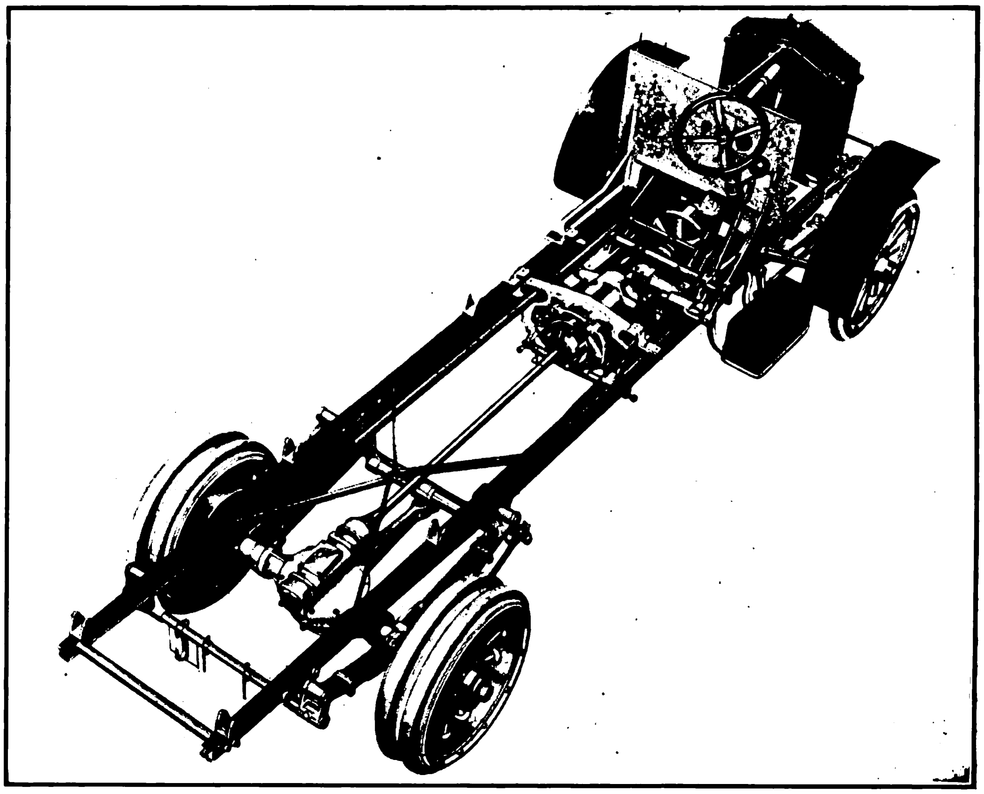
The recently organized Johnstown, Penn., Motor Car Company has plans to erect a factory for the building of a motor wagon from plans developed by R. R. Herchelroth from patents held by him.

PIERCE-ARROW TWO-TON TRUCK.

THE Pierce-Arrow Motor Car Company, Buffalo, N. Y., has begun the commercial production of a chassis having a capacity of 4000 pounds, and is now in readiness to deliver these machines. Like the five-ton truck that has been built for upwards of three years the new machine is worm driven, and it is intended to meet the requirements of those who desire a lighter, dependable vehicle of comparatively fast speed and suited for many classes of work.

In keeping with the policy of the company to build machines that can be regarded as standardized in the broadest sense of the word, and which will serve the purpose of owners in all reasonable working conditions, the design was carefully worked out. Generally it may be stated that the light chassis is a reproduction of the larger, which has been established by experience as being satisfactory and reliable, but in this the company has incorporated such minor improvements and refinements as the experience of three years has established as desirable or necessary. No radical changes were made in the design, and no departure has been made from the methods of manufacturing.

The 4000-pound machine represents all that the engineering force of the company has found practical or useful. It was developed with the purpose of producing a type that could be continued for a long period without change, having the qualities of simplicity and accessibility, with ample margins of safety.

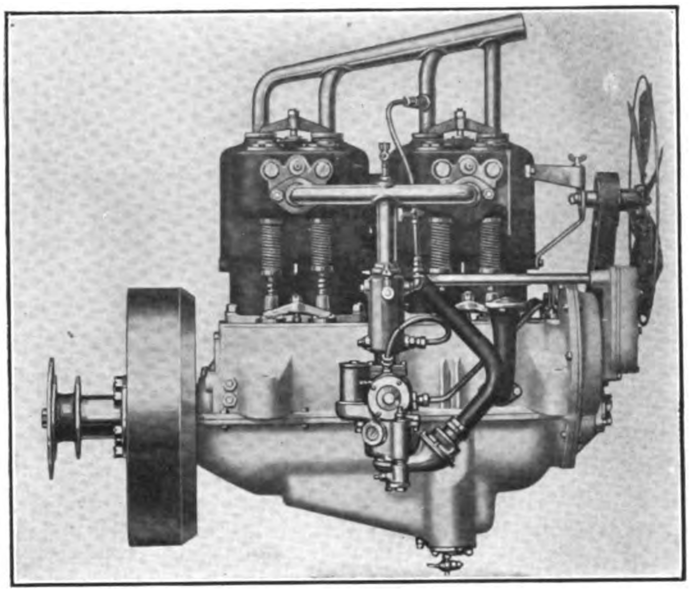


The Chassis of the New Pierce-Arrow Two-Ton Worm Driven Truck.

The motor is practically a smaller type of that used in the five-ton truck. It is a four-cylinder, water-cooled, four-stroke cycle, T head construction with bore of four inches and stroke of 5.5 inches, that is rated by the S. A. E. formulae at 25.6 horsepower, but it will develop 30 horsepower at 1000 revolutions, and it is governed automatically to 1050 revolutions a minute, at which speed, with standard gear reduction, it will drive the chassis at 16 miles an hour. The cylinders are cast in pairs and these, the pistons, the crankshaft, camshafts, connecting rods, valves, valve operating mechanism, timing gears and the fittings are designed and manufactured exactly as are those used in the engine of the five-ton truck.

The lubrication of the motor, which is extremely important, is primarily by a large rotary pump actuated from a camshaft that takes the oil from a well in the base of the crankcase chamber and delivers it under pressure to a large tube extending the length of the crankcase. From this tube passages extend to the main bearings and thence through channels drilled in the crankshaft to the connecting rod big end bearings. From these bearings the oil in excess of the quantity required for lubrication is forced out by the pressure and is distributed in the form of spray by the centrifugal movement of the crankshaft over the interior of the engine, lubricating the camshaft and wristpin bearings, the cylinder and piston walls, the valve tappets and guides. The drainage is collected in the base of the crankcase and is drawn through a filter into the oil well, being used constantly. Practically all of the oiling system is inside the engine case, so that should there be a slight leak the oil drains to the oil well and there is no loss of lubricant. There are two outside tubes, the one leading to the pressure gauge and the relief valve on the dash, and the other the return lead to the crankcase. But four joints are outside the motor case. The height of the oil is indicated by a float gauge.

The motor is cooled by a circulation of water through the spaces in the cylinder jackets by a centrifugal pump coupled directly with the timing gears, and the water is cooled by a vertical tube radiator. The ignition system consists of a Bosch independent magneto, and extreme care has been taken to insure its reliability under all conditions of operation. The system is controlled by a switch on the dash directly connected with the magneto. The high-tension wiring is



The Intake Side of the Pierce-Arrow Two-Ton Truck Motor.

strung through fibre blocks and through the air, insuring maximum insulation. The spark plugs are installed in special sockets above the pistons, and are located where a steady and uniform spark will be produced.

The carburetion is by a standard Pierce-Arrow carburetor, modified to meet the special requirements of the motor. It is an automatic type, easily adjusted and controlled and that it is reliable has been established by long experience. Throttle control is by a foot accelerator.

The clutch is a standard leather faced cone type, with surfaces of large area, and it is operated by a pedal that actuates a fork fitted with two ball bearings, these bearings contacting with the clutch flange and insuring ease of movement and minimizing wear. The mechanism is simple and decidedly effective.

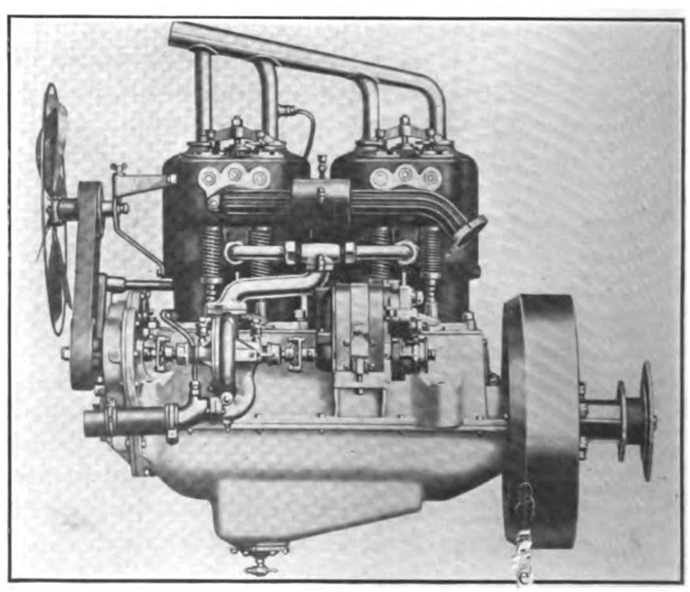
Between the clutch and the transmission gearset is a double universal joint that will compensate for any variance in alignment. The joint is an internal and external gear type, having large bearing surface, and it is so formed that the grease with which it is packed will reach and constantly lubricate the gears. The joint is fully enclosed and is dust and water tight.

The gearset is a three-speed ratio sliding gear type with reverse, and is so designed that a safety clutch prevents more than one gear being in mesh at a time. The gears and shafts are made of high grade steel, carefully heated treated and designed for the stresses they must endure. The gear faces are wide and the shafts are mounted on self-aligning ball bearings, even at the spigot end of the main shaft. The case is made practically oil tight and there is but little probability of loss of lubricant. The gearset speed ratios permit maximums of 16 miles an hour on direct drive, eight miles on intermediate, four miles on low and 3.33 miles in reverse. The gearset is operated by a side lever. The drive is from the gearset by shaft with a universal joint at either end and worm to a gear wheel with which is incorporated a spur gear differential. The rear axle is enclosed in a steel housing and it is a full floating type, the axle shell carrying the full weight of the chassis and load and the axle shafts driving the machine.

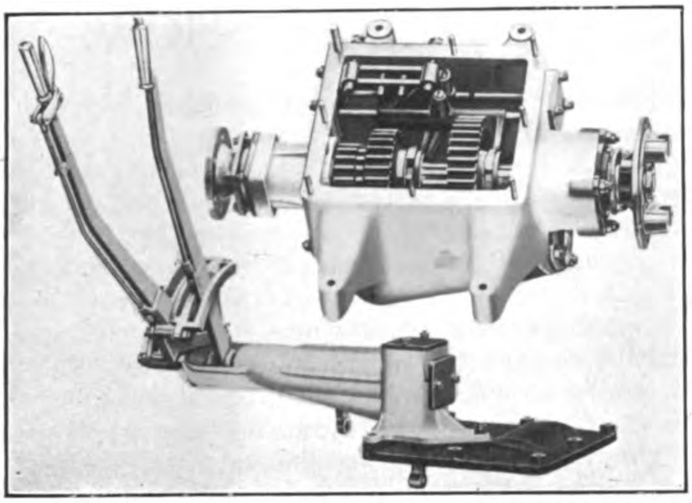
The chassis frame is a channel section pressed from special steel and heat treated. It is 34 inches width. This is mounted on extra long semi-elliptic springs and the forward axle is a special steel forging. The overall length of the chassis is 18 feet six inches, and the width is 66 inches. The wheelbase is 150 inches. The steering gear is a nut and worm type, such as has been used in the larger truck with much success. The relation of the rear axle is maintained by radius rods and a sturdy torque arm from the centre of the rear axle housing to a frame cross member. The driving effort is through the radius rods and there are no driving stresses upon the rear springs. The wheels are of wood, fitted with 36 by four-inch tires, single in front and dual at the rear. The brakes are ample, the contracting band service brake operating on a drum on the driving shaft at the rear of the gearset, and the emergency brake hand lever actuating shoes expanding within large drums attached to the rear wheels.

Unusual care has been taken to minimize the attention to oiling and greasing, and so far as is possible grease cups have been eliminated and a special type of self-lubricating bearing has been used. All the bearing surfaces are ample and all wearing parts are large and made enduring. The fuel tank has 15 gallons capacity, and the feed is by gravity. The cooling system will require eight gallons of water to fill and the oil reservoir for the engine will hold one gallon. In the construction of the chassis all the bearings, save those of the motor, are either ball or roller, and these are of large size.

The motor and gearset are protected against chassis strains or distortion by being mounted rigidly in a sub-frame which is coupled to the main front by a yoke and lug that supports it, while at the rear the frame is carried by two widely separated supports, the effect being a perfect three point suspension. The same support has been used in the five-ton truck with



The Exhaust Side of the Pierce-Arrow Two-Ton Truck Motor.



The Transmission Gearset and Control Levers of Pierce-Arrow Two-Ton Truck.

much satisfaction, but the use of the sub-frame has simplified and strengthened the installation. In every detail the machine has been well thought out and designed for hard service.

The chassis as sold includes the running gear, the mechanism and the tires, the paint being lead color. The equipment includes the driver's seat, dash and footboards, front mudguards, dash and tail lamps, horn, set of hand tools and the metal clips for attaching the wood sills and body to the chassis frame. With a standard body the loading space is 10 feet six inches length and 72 inches width, and the total load that will be admissible on the chassis, including the body, is 5200 pounds.

TWO MONTHS MAKING DELIVERY.

Sixty Days Necessary for Shipment of Stewart Machines to Buenos Aires.

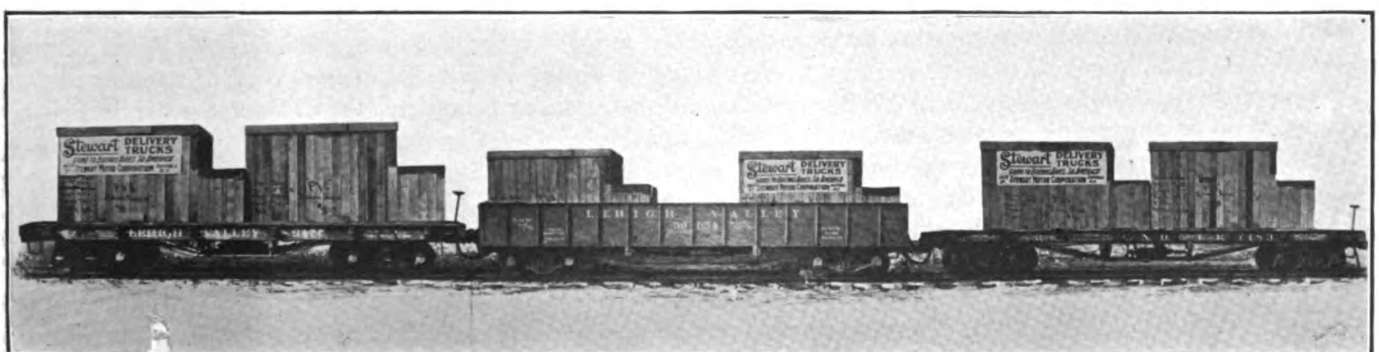
The difference in transportation facilities is greatly emphasized when one contrasts the time necessary for making delivery in any of the European ports and in Argentina, this being due largely to the slower vessels and the fact that the South American lines generally make calls en route. This difference has been especially noted by the manufacturers, who have sought to develop foreign business, for not a little depends so far as the sales are concerned upon the ability of the agents to make deliveries within a period that may be considered as reasonable by the purchaser.

The steamship lines between New York and the southern ports in South America are few and the sailings are at considerable intervals, but while this is true of America, the same condition obtains very generally in Europe and thus far there is no great advantage for the European manufacturers. For the delivery of machines from the factory at Buffalo, N. Y., to the dock in Buenos Aires, Argentina, the Stewart Motor Corporation has found that 60 days is necessary under ordinary conditions. The vehicles are carefully crated and carried on flat cars to New York, where they are transferred to the steamers, but practically all of the time the vessels are at sea.

The steamers are freighters and carry passengers incidentally, and make stops at many of the ports, and as freight must be landed time is required in every instance. Because of the long time at sea unusual care must be taken to prevent the effects of the salt air, and the crating must be very substantial. The company is making shipments frequently to Cuba and the West Indian islands and to Brazil, Uraguay and Argentina.

W. S. Van Clief of Port Richmond, N. Y., a village of the borough of Richmond, New York City, is a lumber dealer, and he has used a Peerless for nearly a year in making delivery to his customers. He uses dead wagons in the yard and these are loaded and made ready for the truck. As the machine is brought to the yard it is backed to a wagon and the lumber is moved onto the truck by a roller at the rear operated by a hand crank and by floating rollers mounted above the deck of the platform. The dead wagon has similar equipment to start the movement of the lumber on it. The load may be bound or merely stacked. However it is placed on the dead wagon one man can handle it when loading, and it can be unloaded by the same means. During the time it has been in use the truck has been driven 10,175 miles on soft dirt roads and has hauled a daily average of 16 tons of lumber. Its maximum day's work has been 65 miles. During the year the truck has been out of service for three days that maintenance work could be done.

The report of the receiver in bankruptcy of the Lansden Company shows that that company has assets of $304,000 and liabilities of $193,000.



Six Stewart Delivery Wagons Leaving Buffalo for Delivery at Buenos Aires, Argentina, Which Usually Requires About 60 Days' Time.

ANNUAL NEW YORK ELECTRIC VEHICLE SHOW.

THE annual New York Electrical Exposition and Motor Show will take place at the Grand Central Palace, Lexington avenue and 46th and 47th streets, New York City, beginning Oct. 15, and it will be concluded the evening of Oct. 25. The exhibition will be under the management of George F. Parker, who has directed these shows for several years, and the plans have so far advanced that it can be definitely stated that it will be larger and better from every aspect than any previously held.

While the show will be devoted to the general promotion of the use of electric current for power, lighting, heating and for manufacturing and household use, a very large part of it will be given over to the display and demonstration of electric vehicles and of facilities for their use, care and maintenance. The Grand Central Palace has an exhibition floor space of approximately 140,000 square feet, and three stories will be utilized for the show.

One section will be given over to a display of electric pleasure cars, another for electric freight wagons and trucks, another for exhibition of accessories, equipment and supplies, a fourth to a track where the machines can be exhibited in motion, a fifth to a model garage, which will be fitted with perfected charging apparatus and service station equipment.

The demonstrating track will be on the third floor of the building and this will be of sufficient width for two vehicles to drive abreast. The track will be set off from the remainder of the floor by brass railing and it will be oval in form. The circuit will be 100 yards. The vehicles can be brought to the floor by elevator and tried on the track under the direction of competent drivers, and this same track can be used for the instruction of those who desire some experience before venturing into street traffic with their machines.

Within the track will be a metal fireproof garage, which will be erected by Andrew Gries & Co., and this building will be a model in every respect. It will be equipped with mercury arc rectifiers by the General Electric Company, with charging panels by the Westinghouse Electric and Manufacturing Company, and with a converter by the Wagner Electric Manufacturing Company. The plans for the garage and its equipment have been developed by a committee representing the New York Electric Vehicle Association, and this committee will conduct the garage during the exhibition.

The intention is that vehicles will be received at this garage as at any public service station, and that they will be stored, charged and given the same attention that would be entailed by daily use. The station will be in charge of a competent manager, who will have the assistance of trained mechanics and electricians. Every work that would be necessary in connection with the use of vehicles or the administration of a garage will be carried on, and there will be an approved system of records that will afford the precise information that is considered desirable to insure economy and efficiency.

The garage will lack nothing in equipment. A large electric display sign will attract attention, and danger warnings will be conspicuous. Besides the charging apparatus, the battery room, the repair department, the stockroom, the washstand, vacuum cleaners, polishing motors, electric air compressors and tire pumps, and the like will be shown. In this garage will be stored the machines of the exhibitors that will be used on the track for demonstrating purposes. Each exhibiting company is expected to have a man attached to the garage for demonstrating, and there will be a special corps of demonstrators under the direction of the New York Electric Vehicle Association committee.

For the benefit of those who may consider engaging in business as manager or owner of electric service stations the repair shop will be equipped with an exhibit of lathes, presses, drills and other machine tools necessary or desirable in automobile repair work made by the United States Electric Company. The battery room will be equipped with complete sets of batteries furnished by the Philadelphia Storage Battery Company, the Electric Storage Battery Company, the Gould Storage Battery Company and the Edison Storage Battery Company.

Within the track will also be a raised platform where an orchestra will be stationed, and musical programmes will be given each afternoon and evening. It is also probable that a series of games will be a feature of some of the days, these being of a character in which the automobiles can be used.

On the main floor the different manufacturers will have exhibition space and will show machines, in some instances both pleasure cars and wagons and trucks, and in others simply the one line produced. From the number of exhibits now assured it is certain that the showing of vehicles will be the largest ever seen in New York.

The committee of the New York Electric Vehicle Association in charge of the automobile department of the exhibition consists of E. W. Curtis of the General Vehicle Company, J. B. Cafferty of the General Motor Truck Company, Nathaniel Pratt of the Baker Motor Vehicle Company, S. W. Menefee of the Anderson Electric Car Company, C. Y. Kensworthy of the Rauch & Lang Carriage Company, Charles A. Ward of the Ward Motor Vehicle Company, W. R. Chandler of the Holt-Chandler Company, W. C. Poertner of the Poertner Motor Car Company, J. M. Barrett of the Automatic Transportation Company, Harvey Robinson of the New York Edison Company and H. C. Fling of the New York Electric Vehicle Association.

The statement is made that the Great Western Automobile Company, Peru, Ind., is to build a motor truck, and that designs for the machine are now being prepared by a Detroit engineering firm.

PEERLESS TRUCK MEETS ARMY TESTS.

Superiority to Foreign Machines Proven by Work in Philippine Islands.

The Quartermaster-General's Department, U. S. A., operating in the Philippine Islands, must necessarily transport large quantities of supplies and material, and with the improvement of the highways the officers have naturally turned to motor vehicles as being superior in every way to any other form of transportation, for the railroads reach only the principal centres of a few of the principal islands. The headquarters of the department are at Manila, and this is the principal point of distribution. One of the stations is Baguio, and this may be reached by both road and railroad.

For transportation purposes the department purchased a number of specially built motor trucks of French build, because at that time no machine immediately available was regarded as powerful enough to do the work. These were rated as two tons capacity, but were fitted with motors and radiators of the size installed in five-ton trucks. One old American truck was used, the power plant being augmented by an engine taken from a steam touring car and coupled to the jackshaft. As might be assumed, this combination of steam and gasoline was not a mechanical perfection, although it could do the work.

The department tried a Peerless three-ton truck and it gave excellent satisfaction, climbing Benguet hill, an exceedingly steep ascent, with varying loads. It consumed less fuel with three and four-ton loads than did the De Dion-Bouton two-ton machines, and during the trial carried from 6340 to 10,900 pounds. With all but the largest overloads the truck was never operated on the low speed, and it did not heat excessively, though only two makes of touring cars have ever climbed the hill without stalling because of overheated motors. On one run with a load of 6340 pounds the truck made the distance in three hours and 20 minutes, which was faster than the train schedule.

Following the experiment the department purchased the only two Peerless trucks in stock in Manila, and negotiated for several others. The power of a truck that would carry a two-ton overload up a hill that no other machine had climbed with a full load has seemingly sufficiently demonstrated the quality of American machines and has probably ended a demand by the army, at least, for European machines.

G. W. A. Wells, formerly chief engineer of the Adams Express Company, has been placed at the head of the newly created department of investigation by the Autocar Company, Ardmore, Penn. The purpose is to investigate and study the delivery and transportation departments of concerns, with a view of determining the number and size of motor or animal units necessary to afford the most efficient service. Mr. Wells was for 10 years connected with the Adams Express Company and was active in the motor installations, that corporation now utilizing several hundred wagons and trucks. He had charge of the purchase, maintenance and operation of the machines, and designed and established the different garages located in various cities. Mr. Wells is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the Society of Automobile Engineers and other well known organizations, and is widely known in transportation work.

Peerless Three-Ton Truck in Service of the Quartermaster-General's Department, at Baguio Station, P. I., with a Load of Iron Pipe.

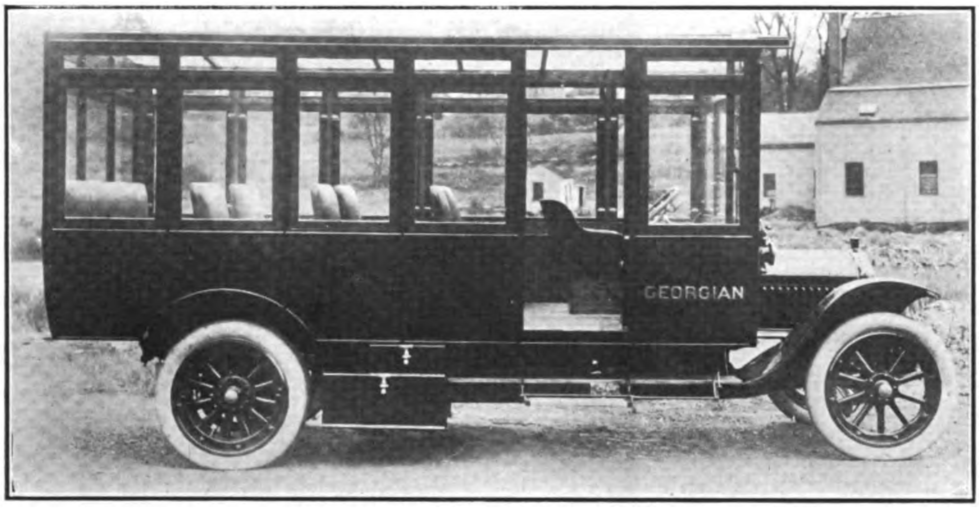
During a recent series of demonstrations to breweries in Philadelphia, a five-ton Atlantic electric truck, with one charge of a 25-MV Hycap Exide battery showed exceptional mileage. In work for C. Schmidt & Sons one run was to Bristol, with city work, covering 46 miles; another to Roxborough and return and to Germantown and to Roxborough and return was about 49 miles; and a third fully and partly loaded and also carrying a partial load of empty barrels was to Chester, to Ardsmore and to Bristol and return, a distance of 52 miles. In work for F. A. Poth & Sons, one day's demonstration was a trip to Frankford, Bristol, Newportville and Tacony, returning to Bristol, thence to Holmesboro and back to the brewery, making 57.5 miles, using 360 ampere-hours of current. The truck was run on fine roads with four ampere-hours a mile, in city grades with six ampere-hours a mile, and on hills with seven ampere-hours a mile, which is regarded as being very economical.

GLASS-ROOFED MOTOR 'BUS.

Unique Vehicle Designed for Service Over Route of Paul Revere's Ride.

A motor omnibus of decidedly unusual body design has been constructed for the service of the John Rockett Taxicab Company, Boston, Mass., which is intended for affording the passengers a very wide opportunity for observation, as well as meeting with all the requirements for comfort and convenience. The company will use the machine in whatever service it may be best adapted for, but its principal use will be in taking sightseers over the famed route that was ridden over by Paul Revere when he roused the Colonists the night before the battle of Lexington, that conflict that inaugurated the successful struggle for American independence.

The 'bus has a standard White 3000-pound chassis and the body is built to extend from the dash and considerably overhang the chassis frame, there being one wide entrance at the right side that may be closed by a sliding door. The step may be raised or lowered by the driver whenever occasion requires. The drive is left side and the machine is entirely controlled from within the body. The body will accommodate 22 passengers, there being transverse seats with an aisle between all save the back seat. The side windows are removable so that there may be unobstructed view at either side, and when removed they are carried in a compartment beneath the chassis frame. To utilize the full capacity of the body there is a hinged drop seat between each set of seats, which may be raised when required, and lowered when the aisle is used for movement of the passengers.



Glass-Roofed Sightseeing Omnibus in Service of the John Rockett Taxicab Company, Boston, Mass.

The body is surrounded by windows and the roof is also of glass, the sections being so secured as to make a very strong and enduring construction. The glass is such as is used in fireproof construction, being reinforced with wire, and in the event of accident there could be no damage or injury from breakage. This roof affords light almost the equal of an open body. The machine is devoid of running boards, and the tires are carried in a compartment. The body is very sightly and it has attracted much attention because of its departure from ordinary constructions.

MAY ACQUIRE ALCO PLANT.

Providence Capitalists Make a Proposition for Its Purchase to the Company.

The directors of the American Locomotive Company are now considering a proposal made by a group of Providence capitalists headed by William H. Draper and Michael W. Norton, the latter being well known as the head of several taxicab service companies, which includes the sale to them of the unfinished machines and material now in the plant. Messrs. Draper and Norton have contracted for 26 Alco trucks to be delivered to them by Oct. 15, and these machines are to be the nucleus of a fleet to be operated by a trucking company doing business in Providence and vicinity.

The original plan for discontinuance of the manufacture of Alco machines comprehended the operation of the plant until the 300 trucks in process of construction were completed, as well as the production of sufficient parts to meet all requirements of owners of Alco machines for a period of five years. The expectation of Messrs. Draper and Norton is that they will be joined by other capitalists, some of whom are now interested in the American Locomotive Company, and that a company may be formed that will take over the plant and continue the production of machines. Negotiations to this end are now in progress and it is probable that definite announcement may be made in a few days.

The Ebling Brewing Company, New York City, is using three Atlantic trucks that have Edison A-12 batteries, and on routes where from 40 to 45 miles a day are required for the work. In tests of the machines upwards of 53 miles have been driven on a single battery charge.

The Kougle Auto Company, that has been engaged in a painting and repairing business at Indianapolis, Ind., has acquired the control of the Auglaize Motor Car Company of New Bremen, O., and will move the plant to Indianapolis, where the Auglaize delivery wagons will be produced under the name of the Kougle machine. The company is erecting a new factory and will later on produce several types of motor vehicles.

COLD STORAGE BAKER TRUCK.

Electric Machine with Special Body for Porto Rican Ice Company's Service.

The Porto Rico Ice Company, at Hielo, P. R., is an important industry in Uncle Sam's West Indian possession, for in that island the temperature is always so high that ice is one of the necessities of life with natives of the United States and other countries. Its use is imperative for the preservation of food, the preparation of drinks and in the event of sickness, and with the increase of the white population the demand has impelled the delivery of ice to points where it may be distributed conveniently. The Hielo company has a plant where ice is produced by mechanical methods, and it has located a sub-station six miles distant. To transport the ice from the plant to the station without material shrinkage was a problem that was met by the purchase of a Baker 3.5-ton chassis on which a specially designed body was built by the Baker Motor Vehicle Company, Cleveland, O.

The company decided that an electric machine would best meet its requirements from the fact that it must have extreme endurance, the height of simplicity and such construction that it could be handled and driven by men having no special mechanical knowledge. As the company constantly utilizes power the current necessary could be produced without additional expense.

The truck chassis is a standard production, but the body as it is built is practically a refrigerator, and it is designed to preserve ice for long periods. Only those who have experience with the climate can understand the needs. The front, sides and roof have double walls that are four inches thick, with the spaces packed with ground cork. The floor is 4.5 inches thick and it is built of inch oak lumber, under which is a layer of asphalt composition 1.75 inches thick, and below this is a layer of cork board one inch thick laid on Georgia pine board .75 inch thick. The rear of the body is closed by double doors and a high tail gate, these being of standard refrigerator construction, with double walls and packed with cork. Any one or all of these may be opened to load or unload the truck. Near the rear end of the body may be seen the drainage outlets, which are trapped so that warm air will not be admitted to the body, and when the doors are closed the body is as tightly sealed as is a refrigerator or ice box. It is practically air-tight, and in it ice can be carried many miles with very little shrinkage. As ice is always expensive in hot countries the wisdom of the body construction is apparent. Within the body is a series of adjustable crossbars by which the ice may be held in place, so that it will not shift in transit. The rear step is folding. In the illustration it is shown dropped for work, but it may be raised to prevent any person riding when the machine is moving. Back of the seat of the driver is a ticket box in which may be deposited the tickets received for ice, for the drivers are not permitted to handle the money, and the customers pay with coupons that are purchased from the company. This box is not seen in the illustration.

Baker Electric Truck Equipped with Specially Built Body for the Delivery Service of a Porto Rican Ice Company.

NEW EDISON BATTERY CELL.

Type Developed for Use in Pleasure Cars and Light Delivery Wagons.

A new battery cell that is known as type A-5 is now built commercially by the Edison Storage Battery Company, Orange, N. J., this having a rating of 187.5 ampere-hours and is intermediate between type A-4 with 150 and type A-6 with 225 ampere-hours capacity. The cell is designed for use in pleasure cars and light delivery wagons and such purposes as where the amperage of the type A-6 cell is not needed. It is particularly adaptable for batteries for 1000-pound wagons, industrial and floor freight trucks.

In every detail the cell resembles the larger and smaller types and it is sold with the guarantee that it will deliver its full rated capacity at the end of four years, provided it has received the attention suggested by the maker. These cells are now being produced in quantities to meet the demand and deliveries can be made as promptly as with the other sizes.

With capital of $250,000 the National Motor Truck & Manufacturing Company has been organized at Gibsenburgh, O., and it is proposed to build a plant at that place, and the company will use the patterns and patents of the Toledo Truck Company of Toledo, O.

PLANS FOR CHICAGO CONVENTION OF E. V. A. OF A.

THE fourth annual convention of the Electric Vehicle Association of America will take place at Chicago, Ill., Monday and Tuesday, Oct. 27-28, and it will be the first meeting of the organization ever held west of New York City. The convention of 1912 was held at Boston during the electric exhibition in that city.

The convention plans were placed in the hands of a general committee named early in the year and they have so far progressed that a general outline of the proceedings can be stated. This committee consists of the following members: Chairman, Homer E. Neisz, Chicago; G. H. Atkin, Chicago; D. C. Atlington, Chicago; Day Baker, Boston, Mass.; William G. Bee, Orange, N. J.; Charles Blizard, Philadelphia, Penn.; W. H. Blood, Jr., Boston, Mass.; Louis E. Burr, Chicago; Hayden Eames, Cleveland, O.; L. A. Ferguson, Chicago; C. B. Frayer, Chicago; W. W. Freeman, Birmingham, Ala.; John F. Gilchrist, Chicago; Uri Grannis, Chicago; James T. Hutchings, Rochester, N. Y.; George H. Jones, Chicago; G. H. Kelly, Cleveland, O.; William P. Kennedy, New York City; E. W. Lloyd, Chicago; W. J. McDowell, Chicago; E. S. Mansfield, Boston; Harvey Robinson, New York City; William L. Rudd, Chicago; P. H. Schaffner, Chicago; Frank W. Smith, New York City; F. M. Tait, Dayton, O.; L. E. Wagner, Chicago; P. D. Wagoner, New York City; Arthur Williams, New York City; E. E. Witherby, Chicago.

This committee has been assisted by the following sub-committees, which have been actively engaged in the work of preparation: Finance, George H. Jones, chairman; Uri B. Grannis, G. H. Atkin, E. E. Witherby, Harry N. Fowler. Entertainment, L. E. Wagner, chairman; C. B. Frayer, P. H. Schaffner. Exhibits, E. E. Witherby, chairman; G. A. Freeman, T. W. Barnes. Transportation and garage exhibition, Louis E. Burr, chairman; D. E. Whipple, Ralph Temple, Harry Salvat, Penrose Reed.

The committee has received assurances that justify the belief that there will be approximately 300 members in attendance, and there will be a very strong representation from the New England and the New York associations, while a considerable number from the South and West will probably be present. The morning of the first day will be given over to registration at convention headquarters at the La Salle hotel, and at noon there will be a luncheon at the hotel, probably with some of the Chicago and other western central stations as hosts.

The first session of the convention will take place at the hall of the La Salle hotel beginning at 2 in the afternoon, and the second and third sessions will take place the morning and afternoon of the second day. The first session will be devoted to the address of President Arthur Williams, the reports of officers and committees, and the presentation of three papers. The intention of the committee on papers is that there shall be three papers read at each session, and the expectation is that these will be fully discussed. The election of officers of the association will take place the second day and the announcement will be made, in all probability, at the third session.

The members will have a dinner at 6 at the La Salle hotel the evening of Monday, and following this will make a trip by automobile to the Fashion garage at 51st street and Cottage Grove avenue, where there will be an exhibition of electric passenger cars and storage batteries and charging apparatus. There is also probability that trucks and wagons will be shown at the garage, but this has not as yet been definitely decided. After visiting the exhibition the members will return to the La Salle hotel for a smoker and cabaret entertainment, which will conclude the evening's formalities.

Tuesday at noon the Chicago Section of the Electric Vehicle Association will have its regular luncheon at the La Salle hotel, and the members and all the out-of-town visitors will be the guests of the local organization.

A general invitation will be extended to the public that may be interested in electric vehicles to attend the sessions of the convention, for it is the belief of the committee that the papers will not only be of especial interest to those identified with the industry and trade, but will be valuable to those now using, and who purpose to use, electric machines for either passenger or haulage work. During the convention rooms on the 18th floor of the La Salle hotel will be used as headquarters and for such exhibition purposes as may be required by builders of vehicles and of equipment and accessories.

The papers to be read will be diversified in character and it is expected that these will deal with subjects that have been given special attention by the association, and in addition the reports of the committee will be of special importance. The papers will be generally promotive and will be in harmony with the purpose of the association to unite all manufacturing, selling and central station interests in a campaign that will bring about a more general use and a better knowledge of electric vehicles.

In building an oil pipe line from the Midway oil fields in California to tidewater at San Pedro, 18 White motor trucks, made by the White Company, Cleveland, O., supplanted 500 Missouri mules. They crossed 40 miles of desert sand, running nine miles on each trip on river bottoms, and with every load climbed altitudes as high as 8500 feet. The total of the hauling contract was 700,000 ton-miles. Before much progress had been made it became necessary to build bridges, put on Indian drivers who could stand the intense heat, and construct desert roads of sage brush and eucalyptus branches. Five of the trucks had previously been driven 100,000 miles each.

ELECTRIC VEHICLE PRACTISE.

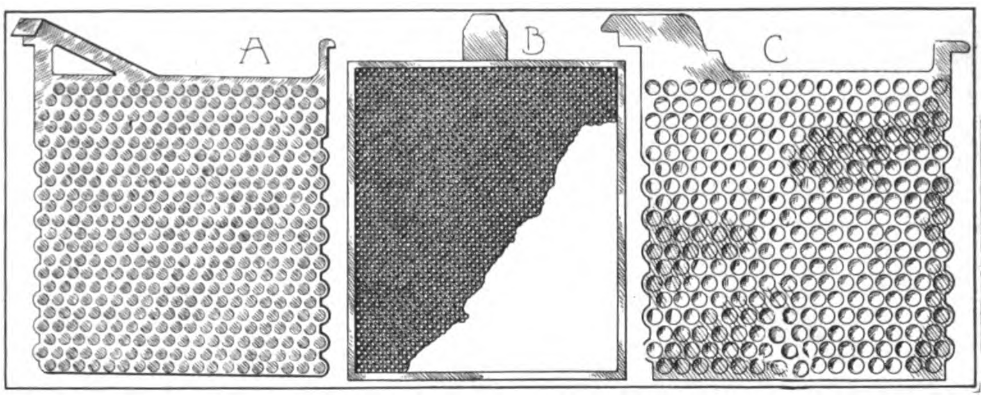
Factors in the Design and the Construction of the Acid Cell Plates of the Plante and Faure Types---Qualities of Several Productions and Conditions That Cause Deterioration---Progressions in Increasing Capacity.

By William W. Scott.

CONSIDERING the formation of the plates used in the acid or lead battery, it is evident that designing has become an engineering proposition, in which the purpose of the designers is, first, to produce what will have endurance, capacity and the lightest weight consistent with the requirements stated; and second, the lowest manufacturing cost that is possible with the quality necessary. Hundreds of experiments have been made with reference to materials and processes, and very careful investigation to obtain the properties believed to be essential. It is apparent that the chemistry of lead battery cell construction is a subject that has no end of ramifications, and research has developed some surprising results, but this information has little if any practical value for the user of the cells, who, were he possessed of this information, would have no actual use for it.

The engineer who designs a storage battery cell does so on the basis of capacity, and the unit is the ampere-hour, this being the equivalent of one ampere flowing for one hour. This refers to the discharge rate, and so the ampere capacity of a cell is the product of the rate of flow in amperes when multiplied by the number of hours that the specified current rate is continued. But as discharge is or may be variable, it will be understood that this capacity can be materially varied. To more closely approximate a definite value a standard has been recognized, this being discharge in eight hours and at a temperature of 70 degrees Fahrenheit, and this is the accepted basis of cell standards of the day. In other words, the capacity is given as that which will afford a stated flow of current for eight hours without the voltage falling below the minimum voltage that is allowable.

Bearing this in mind, and with the given amperage of a cell, the standard rating of current output will be the amperage divided by eight, so that a 120 ampere-hour battery cell will discharge 15 amperes an hour for eight hours continuously, or, theoretically, for eight hours' time, no matter how divided, at the same rate. In designing a cell the capacity is determined by the area of the active material of the plates that will contact with the electrolyte, there being, of course, accurate knowledge of the quality of the active material, and the positive plate area is that accepted, for aside from a two-plate cell, there is always one more negative than there are positive plates in an element. The area is that covered by the electrolyte, the product of the length and width multiplied by two, for both sides are equally active, is given in square inches, and computed in this manner it will be understood that only the surface of the positive plates is considered. So the greater the surface area the greater the capacity of the cell. It is customary with manufacturers to designate cells by letter, number or combination, that is distinctive, these sometimes indicating voltage and amperage, but this is not often the case with vehicle battery cells. The voltage is assumedly the same, or practically the same, with all lead cells, and it may be placed approximately at two volts. When a battery is designed for any particular work a sufficient number of cells is used so that coupled in series the required

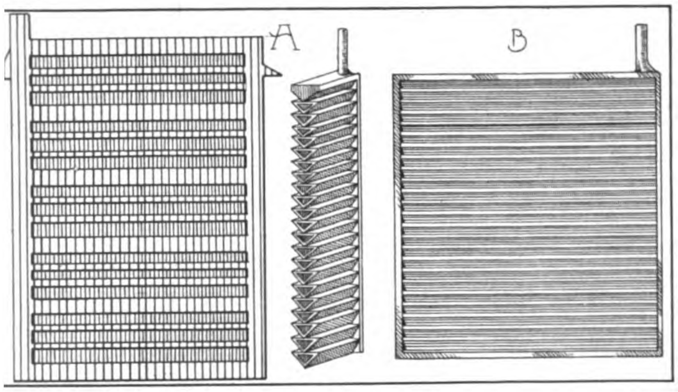


Forms of Construction: A, the Manchester Positive Plate; B, the Exide Negative Plate; C, Another Type of Manchester Plate.

voltage is obtained, and the amperage will be that of the single cell. That is to say: Taking 44 cells with the normal voltage of 2.5 volts when fully charged we have a battery voltage of 110 when connected in series, and the amperage may be, to illustrate, 250 amperes, which is the amperage of a single cell. It will be remembered that the voltage is the pressure of the electromotive force of the cell, and the amperage is the volume of flow of this force.

The design of the cell being determined, the materials are chosen on the basis of known capacity of the element. For instance, it is essential to have the cell as light as is practical, and as there is a limit to the weight of a substantial jar, and the quantity of the electrolyte must not be less than a given volume, the only practical reduction appears to be in the weight of the plates. It may be said that the endeavor of engineers has been directed toward this end in the con-

struction of cells designed for vehicle battery use. But as there has also been a desire to increase the amperage capacity of the cells, this has been very generally



Forms of Construction: A, the Khotinsky Plate; B, the Winkler Plate.

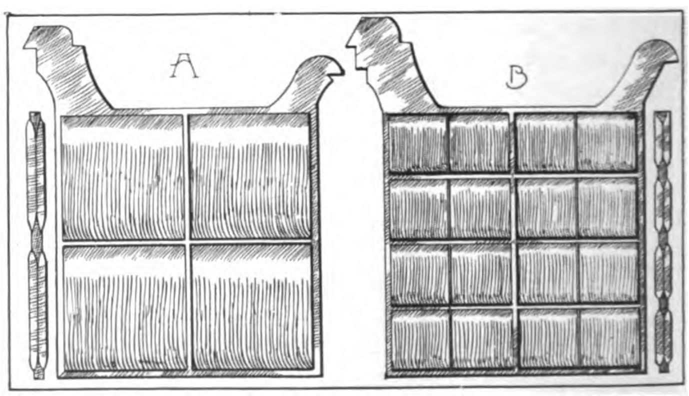
sought by increasing the surface area of the element, which has been accomplished by using a greater number of thinner plates.

Where the battery is used for a stationary installation the weight is secondary, and the cells may be larger and have the full endurance that is expected of the thick plates, but where the battery must be carried, as in a vehicle, the purpose is to reduce the weight so far as is possible and increase the amperage by the use of thinner plates, that will, when used in larger number, expose a greater surface area to the electrolyte. This demonstrates the importance of plate design and construction. In consideration of the types of Plante or formed plates the processes of construction have been briefly outlined, the surfaces being shaped by scoring, swedging, grooving, laminating or casting, the intention being to increase the area so far as may be practical, and the size and shape of the cuts in the plate surface can only be determined by careful experiment. It is necessary to preserve strength, and it is also necessary to have the plates light and sufficiently rigid so that they cannot be distorted by the expansion and contraction from the influences of the electrolyte, for the formations in the channels will be changed as the cell is charged and discharged. Not only this, the formations must not be thrown off, and the channels must be of a form that will best retain them. There is a possibility of the positive plates being subjected to material stresses, through the formation of an excess of oxide, and the distortion may bend (buckle) or expand the plates slightly in a transverse direction and considerably in a longitudinal direction.

Consequently every engineer designs the plates to best meet with the requirements, and the purpose is to minimize the effects described and insure against such changes as would cause deterioration of an abnormal nature. The thickness of the coating of peroxide on the positive plates depends upon the design, and this may be thin or thick. The thin coat is regarded as producing a more uniform voltage on discharge, allows greater rapidity of charging and discharging, and is especially desirable where the current rates are high. But there is a greater degree of surface expansion and contraction, and there is greater probability of the thin formation becoming loosened, so that for cells that are to be charged to maximum and discharged to minimum capacities the thick coating is considered the more enduring. Observation seems to have established that there is less corrosion of the plates where the channels are filled with active material than with the formed type, and there is less probability of distortion through the corrosion. Lead peroxide has greater volume than the lead from which it is formed, and it is this change in volume that causes damage or deterioration.

The Plante plates are all first formed as positives, and after this process the selection of the negatives is made and by a reversal of the process these are transformed to sponge lead. While the original forming was by electrolysis alone, the forming is now generally by chemical, electro-chemical, or amalgamating processes, and of these the second is preferred, and it is maintained to yield the most satisfactory and practical results. Chemical processes are not often used, and amalgamating is seldom employed. The electro-chemical process is to clean the plates, and electrolytic action with different forming solutions causes a rapid formation of the peroxide. Care is taken to eliminate the salts and acids, and then by reversal of the current in a sulphuric acid electrolyte the negative plates are transformed to sponge lead. The processes that may be included under this division are exceedingly numerous, and in many instances differ widely. The efficiency of these methods depends upon conditions and the care taken in treatment, and it would not be practical to state that even under careful supervision exactly uniform results could be obtained, for there is variance in the materials and in the judgment of those utilizing them.

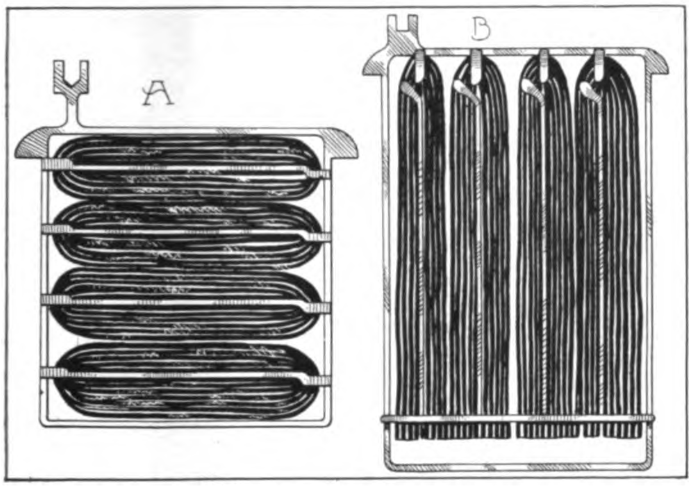
Plates of the Faure type are primarily grids or frames of lead combined with other metals to secure rigidity, the alloys varying from 88 to 98 per cent. of lead, and from two to 12 per cent. of antimony, there being a lower ratio of antimony in the positive frames. It may be said that a very general proportion is about



Forms of Construction: A, the Gould Negative Plate; B, the Gould Positive Plate.

96 per cent. of lead and four per cent. of antimony, but frames are sometimes made of lead, antimony and mercury and sometimes of lead and tin. When more than

five per cent. of antimony is used the frames are brittle and have no ductility, and may be more readily broken through distortion. The value of the composition is chiefly in its power of resistance to oxidization.

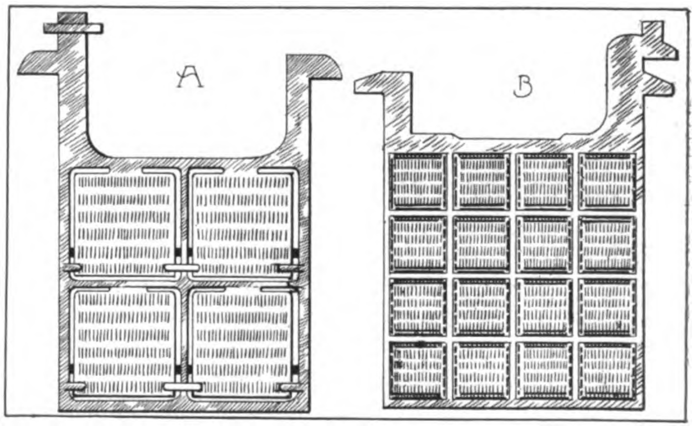


Forms of Construction: A, the Blot Plate with Transverse Laminae; B, the Blot Plate with Vertical Laminae.

It is apparently agreed by authorities that the Faure plate is superior to the Plante type, with reference to capacity a unit of weight, and that the pasted plate can best be used in cells where minimum weight is required. The active material applied to the plates has a degree of porosity and it is penetrated by the electrolyte, exposing a greater surface area, but it has not as high a quality of cohesion and it will, through the alternation of expansion and contraction, become loosened and will gradually disintegrate, this being particularly true of the positive plates. The pasted plate in continuous service has not the same life as the Plante form, and while the endeavor of engineers has been directed toward improvement, the relative values as regards endurance have not been changed. There is no doubt, however, that some forms of Faure plates are more enduring than others. For the protection of plates differing methods have been devised, generally in the form of envelopes and occasionally by shaping the frames.

Many forms of frames are used by manufacturers, each of which has been adopted after careful observation and experiment, and is expected to afford the strength and retaining qualities desired. These may be classified as different grids with either transverse and longitudinal, and sometimes diagonal, members, or they may be with few or many cross members, and occasionally with slots or openings to allow the expansion and contraction of the plates. Some examples of these have been shown, but there is variance with practically every type of cell made, and often distinctive claims are made for the plates as being little affected by the changes during the periods of charging and discharging. In the construction of these frames the purpose is to minimize the weight and secure the greatest strength, making it possible to have the maximum area of active material and insure a satisfactory conductivity. Where the plates are thin the designs are worked out with extreme care to provide the required rigidity and strength. In the production of these plates the active material in a plastic state is placed into the grids and is firmly compacted, often under pressure, to entirely fill the frame, so that when dried or solidified the plate is smooth and even. These lattice-form frames are of two types, those with cross members the full thickness of the plate, and those with the cross members half the thickness of the plate, each intersecting the space formed by the other, dividing it into smaller spaces at the back and affording a support for the active material. These grids are sometimes with horizontal and vertical members, and sometimes diagonal. The frames are formed so that when the material has solidified it is locked into the spaces and cannot be dislodged.

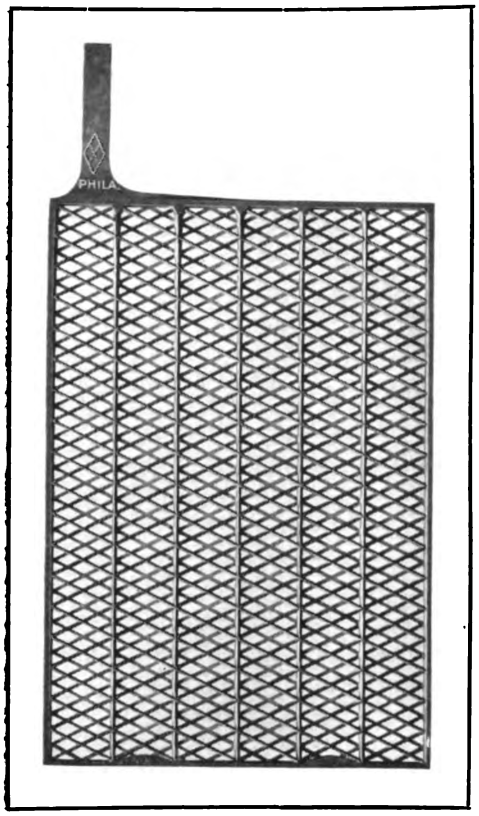
Another class of frame is that in which the cross members are the full thickness of the plate, with occasional heavier members to afford the desired rigidity, these members so shaped as to retain the solidified active material. Still another form is that in which the frames are in divisions, separated by slots of considerable size, and there are the corrugated or channelled frames without perforations, combination of the channelled and perforated types, plates with members shaped to lock the active material, as well as frames that are cast around the active material, and the so-called "box" negatives. The last mentioned are frames with square openings that are filled with active material, and one side of the grid is covered with a perforated sheet of thin lead. Two of these are assembled with the pockets facing, being riveted together, so that the active material is held within the pockets, and the electrolyte reaches it through the perforations in the thin sheets of lead. Attempts have been made to make frames of non-metallic substances to secure lighter construction or to the better retain the active material, but these have not been sufficiently successful to regard them as practical forms. One example of this has been illustrated, this being frames of unglazed porous earthenware with a series of pockets on one side and channelled on the other. The pockets were filled with active material to project above the plate. Two of these plates with a sheet of lead between them formed an electrode, the active material contacting



Forms of Constuction: A, the Unit Accumulator Positive Plate; B, the Bijur Positive Plate.

with the lead sheet, this forming the conductor between the pockets.

The frame is an exceedingly important part of the cell and the design is a very large factor in its efficiency, and extreme care is often directed toward securing the necessary form, alloy and method of formation. It has been said of one manufacturer that two years' constant work and a very large expense were necessary in the perfection of the plate now used, but this has been abundantly justified by the very high results obtained.



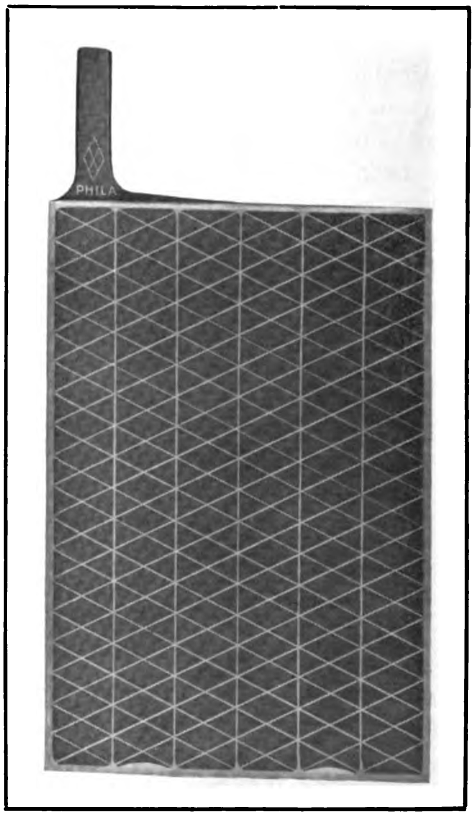
The Philadelphia Thin Plate "Diamond Grid," on Which the Active Material Is Applied.

In some constructions Plante type plates are used for the positive and Faure plates for the negative members of the element. The base of all active materials used are powdered lead or oxides of lead, either massicot, red lead or litharge, and the preparation is sometimes mixed with a proportion of carbon (which increases conductivity), pulverized pumice stone (which increases the porosity), and long asbestos fibre, the last being intended to strengthen the structure, although not adding to its qualities. One of the first composition was litharge, mixed with sulphuric acid, but generally the positive plates are filled with minium or red lead, and litharge for the negative. In the making of the plates the soft composition is forced into the grids, grooves, channels or perforations, and after being solidified by pressure they are dried in the open air from one to two weeks, but often they are dried in ovens at a temperature of about 200 degrees Fahrenheit, being subjected to a bath of sulphuric acid to produce hardness after a certain stage of drying has been reached. The negative plates of litharge (PbO) are treated in a bath of diluted sulphuric acid and reduced to sponge lead by coupling with dummy sheet lead plates serving as anodes and passing a current of electricity through them. In a similar manner the active material of the positive plates are converted from Pb^3O^4 to PbO^2 by connecting them as anodes with dummy plates serving as cathodes.

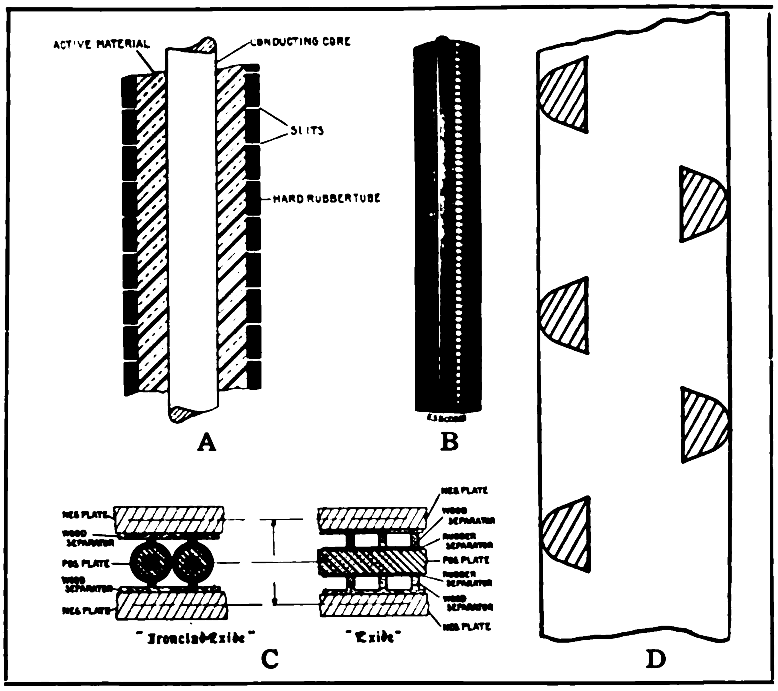
It will be seen from the above statement that the active material as applied is in a form that is easily reduced to the peroxide of lead and spongy lead required for the cells, a process that very much lessens the time and expense of production. The materials stated, however, are not always used. The compounds will differ widely and in some instances acids, alkalis, glycerines and oils are added to secure cohesion, and various substances utilized to secure porosity and conductivity. All plates made by the Faure process, that is, by pasting the active material, must be formed, and despite the best efforts of engineers, no plate has been produced that will have satisfactory efficiency unless worked individually. By this is meant that the active material cannot be prepared, treated in quantity and made ready for application, and neither can plates be made that will be practically ready for use without the electrolysis that produces the conditions in which they are useful.

Electrolytic action can be determined with great exactness, and estimate can be made of the time to accomplish certain results, but in practical working of plates more time is usually required than is indicated by formulae, this from the fact that the penetration of the plates is not always uniform, and other conditions. As an established flow of current is required, and this cannot be exceeded, it will be understood that longer periods of forming means greater current consumption.

Considering the formation of the plates, it will be realized that whether the Plante or Faure type, the negative is required to be sponge lead, and this formation has a considerable degree of porosity, the cells varying in size. The more porous the plates, the larger the area exposed to the electrolyte, and the greater the surface the more potent the activity or influence of the plate. But it is not possible in formation to determine the precise state of porosity, and while plates of a given area are regarded as having a given value, they will probably vary somewhat in potency. This variance, however, is not a material factor.



A Philadelphia Thin Plate Formed and Ready for Installation.



"Ironclad-Exide" and "Exide" Plates: A, Section of "Ironclad-Exide" Positive Plate Tube or Quill; B, Quill of "Ironclad-Exide" Positive Plate, Showing Rib That Serves as Separator; C, Cross Sections of "Ironclad-Exide" and "Exide" Plates as Assembled in a Cell; D, Cross Section of "Exide" Plate, Showing Staggered Construction of the Grid, the Small Shaded Sections Designating the Ribs.

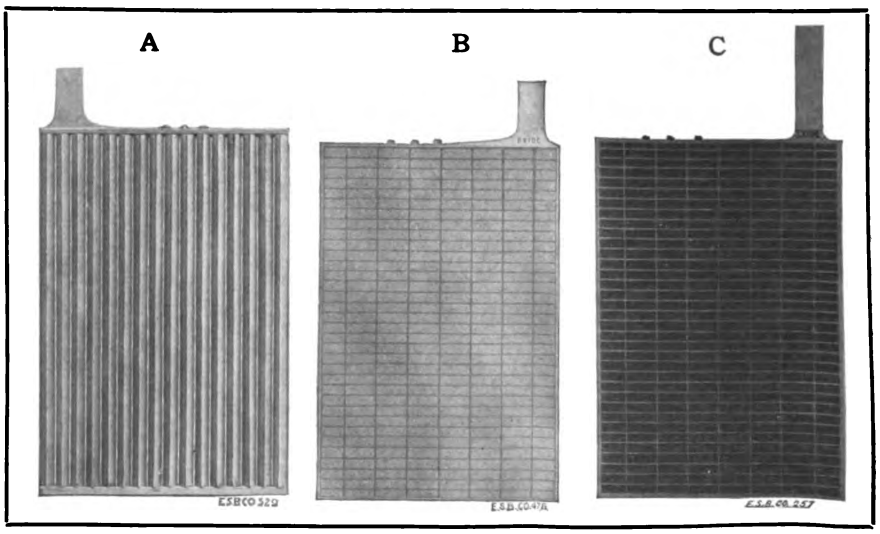
The positive plates, if of the Plante type, have a thin coating of peroxide of lead that is retained by cohesion to the lead beneath, and the efficiency of the plates depends upon the extent to which the electrolyte will penetrate this coating. The peroxide is also porous, and if the electrolyte has free penetration the greater the activity. The coating is assumed to be uniform in depth on the plates, but it will vary considerably. The effective area of the plates depends upon the channels or grooves, and it will be seen this area can be greatly varied. Engineers determine the relative area requirements by assuming a given value a square inch of surface as established by experiments. This active material is subjected to expansion and contraction, and disintegration follows with use, so that the capacity of the plate is reduced, and the porosity is decreased from this and the accumulation of sulphate and crystals of sulphion which are not entirely dissipated by the charging.

If of the Faure type the plates are subject to the same influences that cause deterioration, and there is a gradual loss of potency that cannot be prevented. The loss is more from the positive plates than the negatives, and a broad statement would be that the life of the positive plates is from 50 to 75 per cent. of the life of the negatives. This may differ with conditions and with differing constructions, but generally speaking the negative plates may be used and be found to have good efficiency after the first set of positive plates of the element have been so much reduced as to be comparatively worthless in service. Some very interesting data relative to plate life are available, and it will be presented in the course of the discussions. Although engineers have attempted to reduce deterioration, and different forms of protection have prolonged life to some extent, there remains the stated difference between the positive and negative plates.

As the lead battery cell is used the capacity will gradually decrease, this loss varying according to care and attention. But with all conditions ideal the cell will lose in capacity, although the same, or practically the same, current will be required for charging as when new. The one exception to the constructions of positive plates referred to is the "Ironclad-Exide," made by the Electric Storage Battery Company, in which the positives are lead alloy frames with perpendicular rods extending from the top to the bottom members, these rods being surrounded by thin rubber quills in which is packed lead peroxide. Very thin horizontal slots in the rubber afford the access of the electrolyte, and the lead rods have the necessary conductivity. The lead peroxide has a larger degree of porosity than when formed on the plates, and the entire volume is assumedly potent, while the rubber quills prevent the disintegration of the active material.

Another plate that is claimed to have unusual strength, extreme retention of the active material and a high degree of conductivity, is the "Diamond Grid" form that is made by the Philadelphia Storage Battery Company. The frame is used for both positives and negatives, and, it will be noted, it is a lattice with the openings of "diamond" form at either side, the members at each side intersecting the centre of the opening on the other. When the active material is applied and consolidated under pressure the material in each "diamond" is supported by the "X shaped" members of the frame at the other side of the plate.

(To Be Continued.)



"Ironclad-Exide" and "Exide" Plates: A, the "Ironclad-Exide" Positive Plate; B, the "Exide" Negative Plate; C, the "Exide" Positive Plate.

The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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Information given on request. All advertising copy must reach this office not later than the 25th of the month preceding.

Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

Entered as second class matter, February 25, 1911, at the Postoffice at Pawtucket, R. I., under the Act of March 3rd, 1879.

MOTOR TRUCK DRIVERS.

Owners of motor vehicles who have given the driving of their machines the attention the subject deserves are generally agreed that the average man who is hired as a driver believes that no other work than operating should be required of him, and, in the event of labor being exacted, is disposed to shirk it so far as he can do so without sacrificing his employment. The statement is made that a man employed as a driver of animals expects to load and unload freight as well as drive, and does this work willingly. One serious objection to those who have learned to drive pleasure vehicles, as operators of trucks, is the supposition that no other labor is necessary, and another of equal importance is the difficulty experienced in controlling their desire to drive rapidly, and consequently with indifference to the public. Between the results of the inconsiderate driving, which causes rapid deterioration of the machines, and carelessness, which causes restriction and increases liability, the truck owner must look with some doubt on men who are available, and question the advisability of hiring them.

Probably the condition can best be met by the cooperation of truck manufacturer and purchaser, the latter to send dependable men to the former for a sufficient instruction in operating and maintaining vehicles, and the builder undertaking to educate the men under careful supervision. This suggestion has worked out very satisfactorily in practically every instance it has been tried, and it might be practical for manufacturers to make such provision for the training of drivers. This would insure reasonable operators, willing workers, and longer service of the machines, and the cost of training the men would be one of the best investments that could be made.

SIZES OF TRUCK TIRES.

The builder of the motor freight vehicle has a chassis designed and the weight is estimated. The body installation is optional. The wheels are sometimes specified by the designer and sometimes by the axle maker. The tires are furnished by the manufacturer on a basis of weight to be carried. Seldom, if ever, are tires in excess of the size to carry the maximum freight. The tires might be expected to afford average service were not the owners always willing to load the vehicles to more than capacity, with the result that rapid deterioration is almost a certainty. The one objection that can be made against large sized tires is the additional cost, but no one appears to understand that these are a double insurance in that they will last considerably longer and in the end are no more expensive, while they will not be damaged by work with the truck capacity exceeded. The sale of the larger tires is not really a benefit to the tire manufacturer, for, if he were to profit, this would follow through the use of the smaller shoes, which would be worn to uselessness more quickly.

ANTICIPATING LEGISLATION.

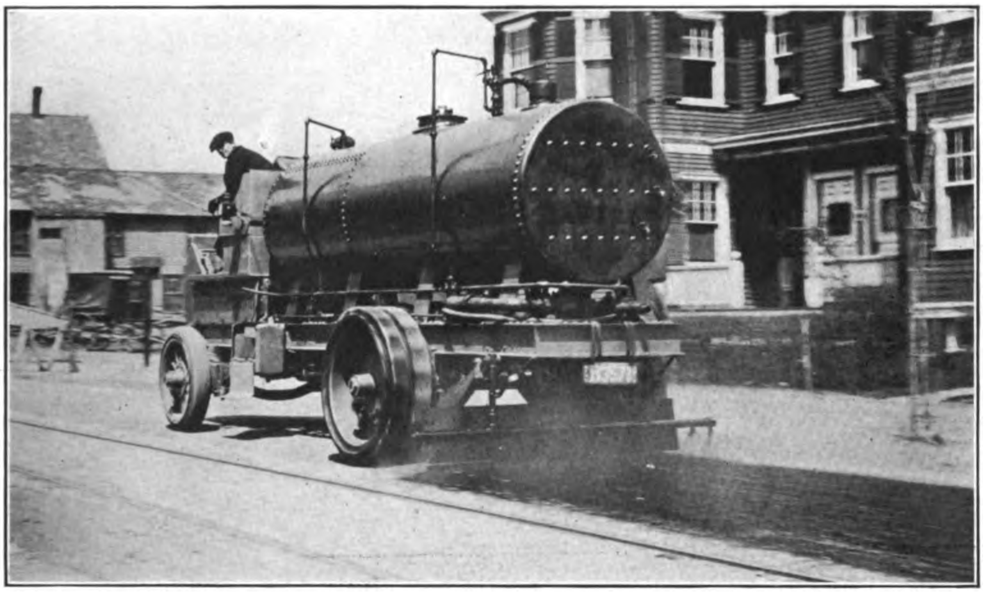
The experience with reference to legislation is a safe guide, and there is good reason in a number of states to expect well organized endeavor to impose greater taxes on machines used for business purposes. In several states bodies of truck owners, distributors and manufacturers have been formed for the purpose of promoting and protecting their interests, and these are in a position to definitely ascertain the attitude of the candidates with relation to taxation propositions. In New York, however, the state organization of the American Automobile Association is maintained by its secretary to favor restriction of the weight and size of trucks. This appears to be a decidedly inconsistent proposal, because this body has not only promoted the state highway system, but has been instrumental in the state expending more than $50,000,000, aside from local expenditures, for road improvement, all, assumedly, for the benefit of the owners of pleasure cars and all forms of horse traffic. Probably 90 per cent. of the motor wagons and trucks in use in New York, and there were about 10,000 in all registered in 1912, are used in the cities, and about 85 per cent. of the highway transportation is in cities. The proposal is to limit the truck capacity to three tons. Apparently the state association is willing to attack the owners of trucks to prevent their use of the road, to which they are equally entitled, so that the motorists may the more enjoy them.

MOTOR TRUCKS FOR ROAD CONSTRUCTION.

The Apparatus Devised for the Haulage of Heated Tarvia and Uniformly Applying It to Highway Surfaces, Used by the Barrett Manufacturing Company.

A COMBINATION service of motor trucks and animal wagons has been developed by the Barrett Manufacturing Company, which has plants located in different parts of the country, that is maintained to be materially economical, and the policy of the corporation is to utilize this equipment wherever it has a station. In keeping with this the company has installed machines in several centres of distribution and is developing its equipment along lines that were practically perfected at Boston.

The company has a business that is general throughout the United States and Canada, and primarily it is manufacturing products from coal tar. Other forms of bitumen are utilized, however. The concern produces building material in large quantities, including roofing, compounds for highway construction, as well as products that are widely used for disinfecting, cleaning, etc. The road material is in three grades or qualities, and it is made of a base of coal tar that is combined with several other ingredients, and is produced by a chemical formula. By refining the compound is brought to a condition where certain necessary qualities are obtained, and there are three grades, one of which has such fluidity that it may be worked when cold, but the other two can only be worked when heated.



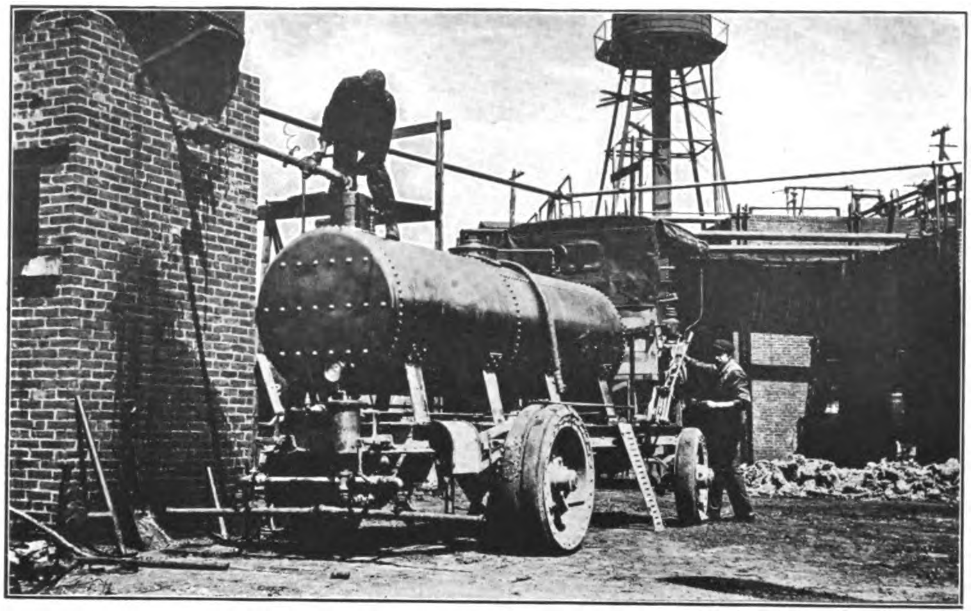
Alco 6.5-Ton Chassis Fitted with 1200-Gallon Tank Used for the Distribution of Heated Tarvia in Road Construction by the Barrett Manufacturing Company, Boston, Mass.

The company has manufactured these coal tar road construction materials for a number of years and they have been used more generally each succeeding year. The corporation maintains refineries in more than a score of cities and different parts of this country and Canada, and has a London, Eng., branch. At these refineries the material is prepared and it is shipped in either tank cars or barrels, or it is carried in tank wagons or trucks to the place where the construction is in progress. There are several methods of working the compounds practically.

With the fluid form, which is the easiest worked, this may be taken from the tank cars or the barrels and distributed by tank wagons, but there is, unless a stated pressure is maintained in the tank, a loss of "head," so that while there will be a maximum spread on the surface from the gravity pressure when the tank is full, this pressure will be gradually reduced during distribution, and the application will be heavier as the quantity in the tank is decreased, but will not cover as wide an area. This has been the experience at all times when distribution of a liquid is made from a tank without pressure, but with water, when used for dust suppression, this condition is not of consequence. When it is necessary to make a reasonably even spread of material the common tank has never been a satisfactory apparatus.

As may be assumed, it is important that any application of tar to a road surface shall be even, and this cannot be secured through manual handling, no matter how great care is given. For this reason a fluid compound should be applied from a tank under pressure. Such a treatment of a highway, however, cannot be regarded as permanent, and it will best serve as a dust suppressor. For this reason a heavier material is necessary, and the desired quality cannot be obtained with any material degree of fluidity, for the compound must solidify when cold. The second grade of material is such that it must be heated, and when this is shipped it must be in tank cars that are fitted with coils of pipe that may be connected with a steam boiler and the contents liquified so they may be drawn off, or it may be shipped in barrels.

After heating in the tank cars the material can be transported a short distance, or under such circumstances that it will not greatly cool, and applied, but this necessitates the use of tank wagons. If shipped in barrels, the containers may be destroyed and the contents melted in large kettles at the roadside, but this necessitates hand application, which is not as even and is far from economical. The third grade of material is



Loading a Tank Wagon with Hot Tarvia at the Works at Everett, Mass., for Transportation to Construction Work.

even heavier and can only be liquified by heat, and its distribution must be by the same means.

With relation to road construction, it may be stated that the unit of work is square yard of surface area, and in the building of tarred highways estimates are made of the volume of material in cubic yards of stone and gallons of tar, and the specifications require that the tar be evenly applied. If the treatment is not uniform the surfacing will not endure under traffic, and if there is a shortage of tar through absence of uniformity, this must be made up, and the cost is additional. As the success of the construction depends upon the quantity as well as the quality of the tar, and economy prompts equality of distribution, it will be seen that equipment for applying the material is of prime importance.

As a matter of business it was desirable for the engineers of the Barrett company to have the work performed so that the best results would follow. In some instances the company supplies the material to contractors and the municipal and state departments, and in others the company, within reasonable distance of the refineries, makes the applications of tar with its own equipment. The company makes recommendations for applications, and, when doing the work, follows these carefully. As the tar can be applied to the road work only when the stone is dry, it is necessary to work rapidly at times, and to take advantage of every opportunity for making the treatments. The company has always delivered the tarvia within a reasonable distance of its refineries. One of the first constructions adapted for use with animal trucks was metal tanks of from 800 to 1000 gallons capacity, which were utilized at the New England branch at Boston. These were filled at the refinery at Everett and were hauled to the construction, the limit being about 20 miles. The tanks were filled with the liquified tar, heated to something like 300 degrees, and on arrival it was possible to apply this without heating. But as application need be uniform a pressure was required. This was supplied by connecting the tank with the boiler of a steam roller, and with the roller towing the truck at a speed of four miles an hour the tar was forced in a spray through a header attached to a hose from the outlet of the tank.

Using a steam pressure of about 100 pounds to the square inch it was possible to sufficiently heat the tar, even if it had been cooled, and it could be forced from the hose so as to insure a desired degree of penetration. This worked out well, but there was the limitation of the horses. The next step was the installation of a tank on a motor truck, and while it was necessary to use this as the horse trucks were used, there was a very much improved radius of movement. With horses the time required for transportation was large, although application could be quickly made, and where the work was of considerable proportions it was necessary to use several trucks, even within short distances. Using the motor trucks the saving was principally in

Applying the Hot Tarvia with a Hose from the Tank Under 100 Pounds Steam Pressure, Supplied by the Boiler of a Road Roller.

transportation, for the machines could be driven a long distance in comparatively short time, and while it was practical to drive even 50 miles from the refinery, with the need of the steam pressure, and the haulage by the roller there was practically no saving in time necessary for application.

Experiments were made in reduction of temperature of the tar during transportation, and it was found that if heated to 300 degrees at the refinery it could be hauled from four to five hours and still have sufficient fluidity to be applied. In other words, the time of the steam roller and its crew could be dispensed with, provided there was a means for forcing the tar from the tank under pressure. Not only this, the tank capacity could be increased to the maximum of the truck, and this was a further economy as compared with horses.

A tar spraying apparatus, built by an English firm, was imported by the company, but it was not adapted for use in construction, many of the parts being so light as to break when used in construction, and as these could not be renewed save by orders that required a month's time to fill it was not regarded as economical, though it would have no doubt been serviceable in surfacing roads that were completed and were smooth, such as it was designed for by the maker. To prevent delays special equipment was necessary, and with the area of distribution considerably extended the need of reliable apparatus was evident.

The first truck used was equipped with a tank and was used as were the wagons, with the steam roller, but the second machine was considerably improved. This was provided with a power pump, driven from the transmission shaft, and with this it was practical to force the 1000 gallons in the tank through two headers at the rear of the chassis in 75 minutes. By driving the truck a mile along one side of a roadway and returning, a surface 14 feet wide could be tarred in an hour and a quarter, this application being uniform in every respect, and the distribution covering a precise area. As it was possible to deliver tarvia heated at the works at a distance of 50 miles at a temperature that it could be worked, and applied to the approval of the engineers, it will be seen that the equipment was in itself a decided success.

A careful record was kept of the work performed and it was found that while the economy of horses for short hauls, using the steam roller method of distribution, was evident, for any distance from six miles to 25 there was a large measure of saving with the truck apparatus. Beyond 25 miles, however, there is a belief that the cheaper transportation is by tank car, leaving the application to the purchaser of the material. This is, of course, from the viewpoint of the company, and there is no allowance made for the better application and the standard quality of the work.

The first season the company had two trucks in service, one of them a three-ton and having an ordinary tank, and this was supplemented by a five-ton truck with a regulation tank equipment. Last year the company installed two more at the Everett plant and purchased others for use at New York and Montreal, all of these being fitted with power pumps. This year the number has been increased and these have been considerably improved. In fact the latest machine may be regarded as standard equipment.

The latest apparatus consists of a 6.5-ton Alco chassis, on which is installed a 1200-gallon tank that will stand several hundred pounds pressure. This tank has a large manhole at the top, where it may be filled by gravity from the large tanks at the refinery. At the rear of this tank is the outlet, and this is connected with a system of pipes, in yoke form that carry at either end of the yoke a header that may be adjusted to spray at any angle, and which may be set at any desired height above the road surface. Normally the spray is applied transversely across the path of the truck, covering an area seven feet wide, but this can be varied as desired. The tank is fitted with coils of pipe that may be connected with any steam plant so that in the event of the contents cooling it may be liquified.

Sand Spreading Wagon, Used for the Application of a Top Dressing on Oiled or Tarred Street by the Public Works Department, Providence, R. I.

On the driving shaft, forward of the gearset case, is a sprocket, and this may be connected by a sliding clutch so as to turn with the shaft by linkage with a hand lever that rises within convenient reach of the driver. By a chain this sprocket is coupled with a shaft above the chassis frame that parallels the driving shaft and ends at a rotary pump located on the chassis close to the rear end of the tank. At will the pump may be operated by movement of the hand lever, and

the contents of the tank forced through the system of pipes at a pressure of 100 pounds, and this pressure may be varied as desired. In the event of necessity the pump may be reversed and the tank filled through the pump, the pumpage being approximately 1000 gallons an hour. At the rear end of the tank are three try cocks, by which the height of the contents may be learned. The pumping plant is controlled by pedals, so that the application can be made as required, and in the event of the flow being stopped and the pump operated the tar will by-pass into the tank and there will be no loss of material.

Very accurate record is kept of the operation of the machines, and taking a five-ton truck, the expense, including gasoline, oil, grease, repairs, tires, cleaning, wages, depreciation, interest, taxes and fire and liability insurance is carefully itemized. A year's work for this truck shows the following figures:

Average miles a day	41.14
Ton-miles a day	100.50
Gasoline, miles a gallon	2.46
Total cost a mile	$0.316
Cost a ton-mile	0.130

Taking this as a basis of the work, it is found that there is but little difference in the expense of each vehicle, and the above may be said to be fairly representative of the cost of the trucks.

FEDERAL IN CANADA.

Makes Long Cross Country Trip Over Poor Roads Without Need for Adjustment.

A Federal truck, made by the Federal Motor Truck Company, Detroit, recently made a trip from Winnipeg to Regina, Saskatchewan, Canada, a distance of 464 miles, in 42 hours of running time, with a load of 7500 pounds. The cargo consisted of a load of bed springs and mattresses from the Alaska Bedding Company of Winnipeg to the Alaska Bedding Company of Regina.

Four days were consumed in the run, the average mileage being 116 miles. The road conditions were extremely bad during most of the trip, a great many sand hills and sandy stretches being encountered, especially around Carberry. From Moosomin to Greenfell there are practically no roads, so that the truck had to pass through trails and cross sloughs where planks were laid to keep the vehicle practically free of water. It was not found necessary either to make adjustments during or after the trip.

ORDERS WHITE TAXICABS.

Chicago Concern Influenced by Successful Installations in Other Sections of the Country.

Closely following a sale of 63 White taxicabs to the Taxicab Company of California, the White Company, Cleveland, O., maker of White pleasure and commercial vehicles, reports another large sale of 50 machines to the Owen H. Fay Livery Company of Chicago, one of the largest cab operating concerns in that city. The order includes 48 taxicabs and two 40 horsepower touring cars.

The California company operated 19 White cabs for almost two years before filling out its fleet to 82. The Chicago company, however, has not used White cabs, but has noted their work in the service of other concerns and was largely influenced by the decision of several large operators to employ White machines.

NEW YORK'S TAXICAB ORDINANCE.

Operating Companies Seeking Various Means to Avoid Complying with Its Provisions.

The board of aldermen of New York City recently enacted an ordinance that establishes a new rate of taxicab fares and abolishes the private control of cab stands by hotels, cafes, etc. Some of the largest companies, chief among which is the Yellow Taxicab Company, have sought to enjoin the city from enforcing the provisions of the ordinance, on the ground that enforcement would mean practically confiscation of their property because of lessening their earnings through reduction of the fares.

Failing in this a restraining order was sought by taximeter manufacturers, because it was claimed to be impossible to provide the class of indicating instruments required by the ordinance from lack of manufacturing facilities, for a considerable period of time. Next, some of the protesting companies founded stands on private property and in this manner evaded the ordinance because business is not solicited on the public streets. Several large companies have complied with the ordinance, which was advocated by many who owned a few machines and who assumed they would profit by the reduced fare. Meantime the city authorities are seeking means for bringing all taxicabs within the provisions of the ordinance, and the resisting companies are fortifying themselves so far as they can and are charging the old rates.

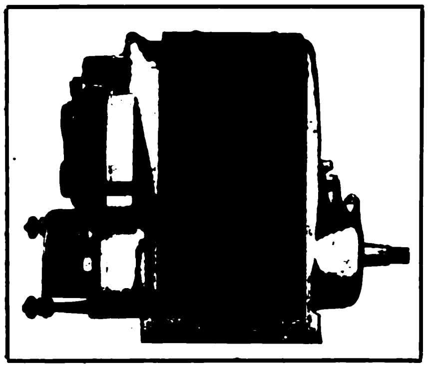
George M. Winslow, a piano dealer of Waukesha, Wis., is a highly pleased convert to the sound theory that motor delivery is distinctly worth exploiting. Since he purchased a 1500-pound KisselKar truck, made by the Kissel Motor Car Company, Hartford, Wis., he has kept that fact persistently featured in his local newspaper advertisements with what he declares to be highly satisfactory results. He has found that people appreciate the superior reliability and speed of motor delivery and make their purchases from merchants employing it.

The contract for transferring the mail below 42nd street in New York City, which was awarded to the Postal Service Transfer, Inc., May 2, went into effect Sept. 1. One hundred motor trucks have replaced the horse wagons previously used in this work.

FEATURES OF NEW MODEL P REMY MAGNETO.

ANNOUNCEMENT is made by the Remy Electric Company, Anderson, Ind., well known maker of ignition and lighting instruments, of a new high-tension magneto which is to be known as the model P. The new instrument is of the wire wound armature type, producing a dynamic spark of great intensity with a distinct flame characteristic. The design is in no way radical or freakish, embodying as it does standard proven practise, and was carefully developed by the Remy engineers. Refinements of design and improvements for greater efficiency have been incorporated wherever possible, these being based on the 15 years' experience in the manufacture of ignition apparatus.

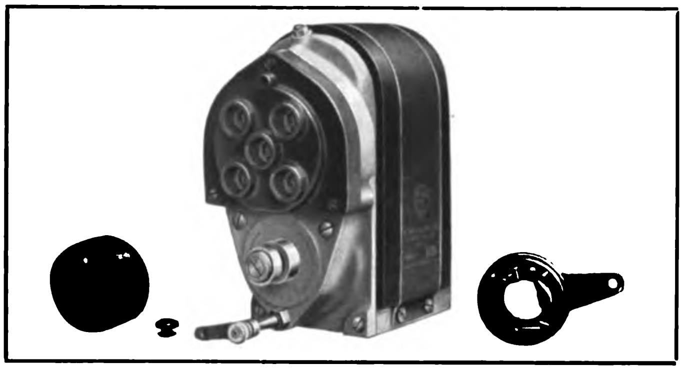
The new magneto is held to be absolutely water and dust proof. The end bearing plates are carefully and accurately machined to fit the magnets and the distributor is also similarly machined to fit the gear-case. A special packing is utilized in all joints to exclude water, oil, dust, etc. The distributor terminals are of water proof design and at the same time provide a reliable method of securing the high-tension cables. The circuit breaker is thoroughly protected by a cover of Bakelite, a heat resisting material of high dielectric strength, which is held to be decidedly superior to hard rubber or composition material, it being pointed out by the company that it is stronger, tougher and will not warp or crack, when exposed to heat, being non-hygroscopic.



New Model P Remy Magneto.

The armature heads are of special bronze and the drive shaft is of a high grade steel cast into the armature head, providing a very rugged construction. The coupling end of the shaft is tapered, keywayed and threaded to S. A. E. standards. The armature winding is of cotton covered, enamelled wire, heavily impregnated with Bakelite, rendering it impervious to heat and moisture. The armature shaft revolves on special magneto type ball bearings protected from foreign elements by felt washers.

The circuit breaker of the new magneto has been improved over previous designs and is held to be exceedingly fast as well as positive in its action. It may readily be removed by the hands for inspection and its simplicity is apparent by the accompanying illustration showing the mechanism disassembled. It is claimed by the company that adjustments are unnecessary under normal operating conditions. The circuit breaker is constructed of a high grade chrome nickel steel, hardened in pyrometer equipped furnaces, ground to size and tested accurately for synchronism and degree of hardness. The timing lever may be attached to either side of the magneto as the circuit breaker and its housing are reversible. The timing range is ample, 35 degrees, and by carefully proportioning the magneto and coil it is held that practically the same intensity of spark is obtained at full retard as at the maximum advance.

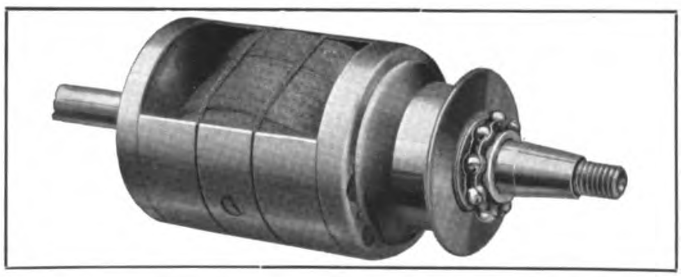


Circuit Breaker and Housing Dismantled to Show Simplicity of Construction.

The terminals of the spark plug cables are located in the face of the Bakelite distributor and are water proof as previously pointed out. Provision is made for easy timing of the instrument, an ingenious device known as a timing button being incorporated in the distributor. This permits bringing the circuit breaker into its proper position, as well as locating the proper terminal of the magneto. It also eliminates opportunity of connecting the wrong leads, a feature which will appeal to those who care for their own cars.

The distributor gears are accurately cut, 24 pitch teeth being utilized. The large gear actuating the distributor proper is of bronze, while the smaller member on the armature shaft is of cloth and steel, a design insuring quiet operation. The distributor brush holder is of Bakelite and is rigidly mounted upon the brass distributor.

The magnets are constructed from a high grade tungsten steel especially heat treated and hardened. The condenser and case form the top plate or cover over the armature, and the condenser is well protected by being imbedded in a heat solidifying compound. In addition to being made moisture proof in this manner a Bakelite cover is utilized. A new coil is employed with the magneto, having an integral dash switch, and a locking device is incorporated.



Heat and Moisture Proof Armature Revolving on Special Type of Ball Bearings.

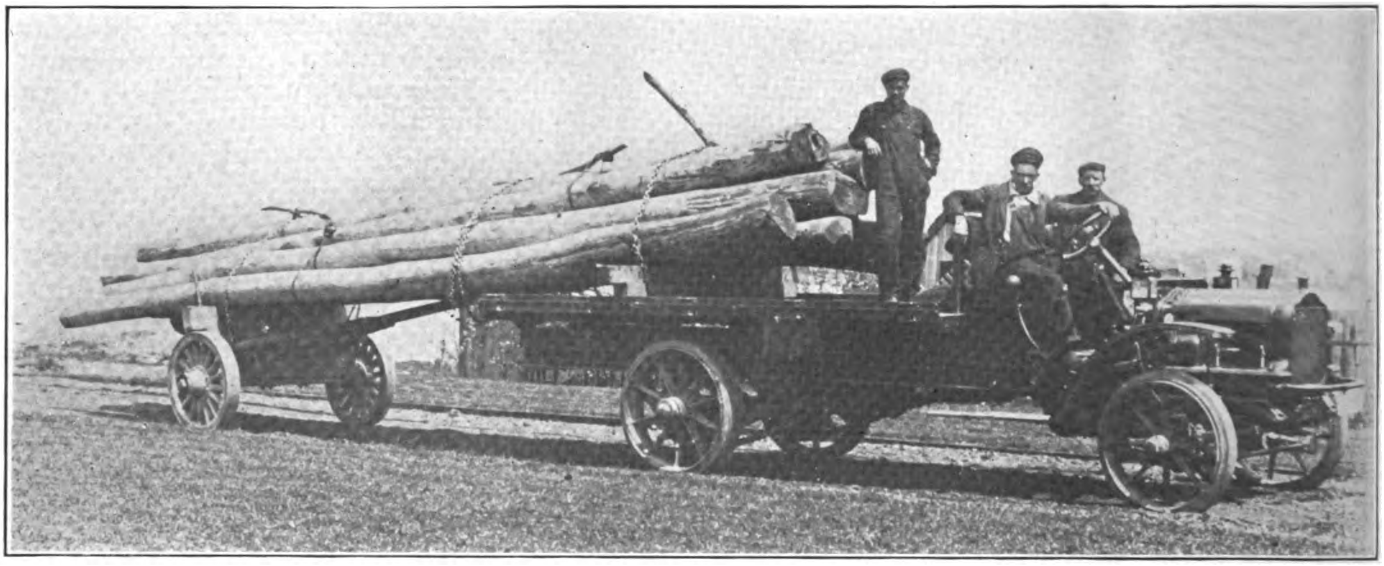
WHITE TRUCK IN ELECTRIC RAILWAY SERVICE.

Utilized as an Emergency Wagon Its Work Is Greatly Varied---Annual Maintenance Figures Show Total Mileage of 7953 at an Expense of 27.73 Cents a Mile.

OPERATING a three-ton White truck, made by the White Company, Cleveland, O., an average of 21.75 miles a day for one year at a cost of 27.73 cents a mile, the Union Street Railway Company of New Bedford, Mass., through its general superintendent, Elton S. Wilde, says that, "considering the various kinds of work this truck has performed, we feel satisfied with our investment." An investigation of the installation reveals the fact that the machine has been given a severe test, although there is no evidence that it has been overloaded or subjected to undue stresses.

New Bedford is situated on an arm of Buzzards Bay and might be regarded as a terminal city for several trolley lines extending into the interior, southwestern Massachusetts being plentifully supplied with electric railways of this type. The Union Street Railway Company operates the lines within the city proper from New York, while the remainder comes over the railroad from Boston. Of course, the wharves are located at sea level and the railroad freight yards are not far distant. The residential portion is built on a hill, the topography of the city being such that it is long and narrow, with the length running along the top of the hill or on its sides parallel thereto. It is less than a mile from the lowest point to the highest, and the grade is not steep at any point. The street railway serves the business and factory districts, as well as the residential and suburban sections.

The truck was purchased of the Auto Selling & Supply Company, John S. Coy, manager, Pleasant and Spring streets, local agent for the White Company. It was placed in service March 1, 1912, and the figures submitted herewith were compiled to Feb. 28, 1913. It was secured primarily for hauling rails, ties, poles,



White Three-Ton Truck in Service with Union Street Railway Company, New Bedford, Mass., Hauling Poles.

and those leading from New Bedford to a number of so-called suburbs, among which may be included Fairhaven and Onset. It also operates the connecting line between New Bedford and Fall River.

As is true of most cities of its size (96,000 in 1910), similarly situated, there is demand for trolley service to numerous seaside resorts in the immediate vicinity, and in addition the company is interested to a large extent in the development of an outing park, known as Lincoln Park, about half-way between New Bedford and Fall River. During the summer months, a theatre and other diversions are maintained at this point in an effort to attract larger crowds than otherwise would be the case, and from time to time special events are held there, these including a fair. This comment is of importance, as will be indicated later.

Some of the freight reaches New Bedford by boat wires, etc., in construction and maintenance work on the different lines of the company. Much of this material comes into New Bedford either over the steam railroad or by boat. The yard of the company is located at Purchase and Weld streets, on the so-called lower level. It follows that the truck is called upon to traverse the hill when communicating with the lines to the westward, and cross the bridge into Fairhaven when working on the suburban lines to the east and north on that side of the river.

For the most part the streets of New Bedford are well paved, the surface being asphalt, bitulithic or macadam, except in a very few instances. There are no better roads in the country than in Fairhaven, these having been built under the street superintendency of the late H. H. Rogers, of Standard Oil fame, who contributed annually much more than his salary as super-

intendent to build up a road system second to none. Many of the country roads are state highways, the surface being oiled macadam. It goes without saying, therefore, that the road conditions under which this machine has been operated are well nigh ideal.

It has been stated that the truck was purchased primarily for hauling material in construction and maintenance work. When Mr. Wilde was asked to state what kind of work it had been engaged in, he replied: "It would be somewhat less difficult if you were to ask me what sort of work it has not been called upon to do." It is an emergency wagon in every sense of the word, and as such is in commission 24 hours of the day. At times it is busy in the service for which it was intended. Sometimes it is in charge of one man. At other times it is hurrying over the road at its best speed with 15 or 18 section hands and a load of poles and wires to mend a break in the line. It has served as a tower wagon. It has transported exhibits, etc., in promoting Lincoln Park. When not otherwise employed, it carts away the ashes that accumulate at the power station. Sometimes it carries a capacity load, and at others it is worked light. It is at the beck and call of the entire system. It goes wherever it is needed, at all hours of the day or night, week days and Sundays. Therein lies the severity of its test, rather than in poor roads or other conditions which would be regarded as severe in other industries.

Mr. Wilde has an admirable bookkeeping system with respect to this machine. MOTOR TRUCK is not interested in presenting figures which shall reveal the business of an individual concern, although its representatives often have opportunity to go over the books of companies employing mechanical transports. It will not be amiss to state in this connection that at no time has the writer seen a statement of maintenance costs so well tabulated as that presented by Mr. Wilde for inspection. For instance, on one occasion this White truck was called upon to tow another machine to a local garage. Mr. Wilde is able to tell exactly what that piece of work cost his company. This statement is made because of its bearing upon the figures presented herein. There can be no disputing such evidence.

During the year, the truck was operated 7953 miles at a total cost of $2205.09, or at the rate of 27.73 cents a mile. This total represents the maintenance account alone and does not include any charge for driver or crew. It will be noted, from the accompanying table, that some 15.23 cents of this is made up in overhead, this including depreciation at 15 per cent., interest on the investment at five per cent. and insurance. The depreciation is figured on the chassis, minus the tires. A sinking fund for annual overhaul and repairs, amounting to $400 a year, has been established, but it would appear from the table that, including all that could by any means be charged to this account, this fund was lowered but $224.27 during the year, so that there was a balance of $175.63 to be carried forward March 1.

The subject of tires always is of interest. This has proven the most troublesome of all with the Union Street Railway Company, despite the excellent character of roads over which the vehicle has been operated. It may be stated in explanation of the situation that the company and the tire maker have had some little controversy over the matter of adjustment. For this reason, Mr. Wilde does not feel justified in taking up the subject in detail. His figures show a tire cost of 4.87 cents a mile. The machine is shod with solid rubber all around—dual equipment on the rear wheels.

Union Street Railway Company's White Truck Engaged in Transporting Rails in Construction Work.

In considering the matter of gasoline, it must be remembered that the price was somewhat different in 1912, these figures being up to and including Feb. 28, 1913. The fuel cost of 2.24 cents a mile works out at a satisfactory consumption when reduced to miles a gallon, although the cost figures for the present year undoubtedly will be somewhat higher. In this connection, it may be stated that Mr. Wilde has compared the fuel cost with such figures as he has secured respecting trucks of other makes, and feels well satisfied.

The item "Top" needs explanation. The machine was purchased without a top over the driver's seat, and it was decided later to add this comfort. The expense was charged to the maintenance account, although perhaps there might be a just claim against such procedure. It may be added here that the machine was out of commission practically two days during the year, on account of tire trouble. It also was laid up for painting.

Annual Maintenance Account of White Three-Ton Truck in Service with Union Street Railway Company, New Bedford, Mass.*

	Mile	Total
Gasoline	$0.0224	$178.15
Grease	0.0048	38.17
Oil	0.138	109.75
Supplies	0.0029	23.06
Labor, painting, etc.	0.0282	224.27
Top	0.0042	33.40
Tires	0.0487	387.31
Overhead	0.1523	1210.98
Totals	$0.2773	$2205.09

*Cost a mile taken from company's books; totals carried out on basis of 7953 miles actually travelled.

It might be suggested as a little strange that a concern engaged in the production of electricity should utilize a gasoline truck. It must be remembered, of course, that the voltage of the current used for street railway purposes is somewhat higher than that utilized for lighting, etc., but it would be possible to employ a transformer, so that the cost of current would be governed solely by the matter of production expense. Basing an estimate on the prevailing price of current in New Bedford, 3.5 cents a kilowatt-hour, and the total mileage for the year, Mr. Wilde believes an electric truck could be operated just as economically as this gasoline machine.

In some respects, an electric vehicle would prove quite as efficient, in Mr. Wilde's opinion. He cites the use as a tower wagon. When the men are at work repairing a break in the wires it often becomes necessary, or at least more convenient, to move the truck a short distance—less than a foot. When it is a matter of cranking the engine and manoeuvring into position the workmen prefer to "stretch" a point rather than move the truck. With an electric machine, Mr. Wilde believes it would be easier to make the required change of position.

At the other hand, while the total mileage for the year, 7953, divided by 365 days, the number of days in which the truck was on duty, shows an average daily mileage of 21.75, this statement does not accurately describe the situation. The manner in which the truck has been worked precludes the possibility of arriving at an average daily mileage as with machines utilized in other lines of business. One day it may travel 35 or 40 miles, while the next it may be kept busy on work which calls for considerable waiting and comparatively small mileage, and at all times it is available night and day. The special service required had its effect in arriving at the decision to purchase a gasoline vehicle.

Another point that will be raised is the comparative expense of horses. Unfortunately, it is impossible to give such figures. Mr. Wilde explains that it would be impracticable to use horses, for the reason that the work is so variable. On some jobs only one horse would be required, while with others perhaps it would need three or four. The truck is available night and day, and weather conditions have no effect upon its efficiency. It is as ready to respond at night after a hard day's work as it would be if it had been "resting" for hours. Extreme heat, or snow and ice, make no difference with its availability.

In many respects this installation is of particular interest. The accompanying tabulation is especially valuable for the reasons given herein. It ought to afford a splendid opportunity for the prospective purchaser to gain reliable information as to what it costs to maintain motor business vehicles, although local conditions will have to be considered. "We are pleased to endorse the White truck," says Mr. Wilde, and he is satisfied that it is an economical proposition.

SAURER TRUCK OPERATING COSTS.

Interesting Figures for Six Months Submitted by Brooklyn Chemical Concern.

The Crescent Chemical Manufacturing Company, Brooklyn, N. Y., reports some very interesting operating costs, showing what it has done for some time past with a Saurer truck, made by the International Motor Company, New York City. It states that during a period of six months it operated the vehicle 199 days, a distance of 8879 miles, or an average of 44.6 miles a day, at a cost of 12 cents a ton-mile. The account rendered by the concern of its operation of the truck was as follows:

Month	Mileage	Days in Operation	Maximum Mileage	Minimum Mileage	Load Out Lbs.
March	1120	24	75	27	404,250
April	1070	23	72	33	470,250
May	734	15	72	12	264,000
June	1074	25	57	27	445,500
July	1274	26	74	29	486,750
August	1147	26	74	20	437,250
September	826	19	67	24	338,250
October	919	25	66	16	387,750
November	185	4	65	32	66,000
December	530	12	61	13	198,000
Total	8879	199	..	..	3,498,000
Estimated load incoming, 70 per cent					2,448,600
Total haulage					5,946,600

Expenses.

Chauffeur	$831.57
Helpers	903.50
Garage rental	230.00
2015 gallons gasoline	342.55
Oils and other supplies	213.12
10 months' insurance	318.75
10 months' interest	250.00
10 months' amortization	416.60
Tire repairs	532.74
General repairs	355.16
Total charges	$4393.99

Or $22.08 a day, 49.5 cents a mile, $7.47 a ton and about 12 cents a ton-mile.

"These figures give as accurately as possible the total cost of delivery," says the company. "There have, however, in the meantime been accumulated the following reserve funds:

For amortization	$416.60
For tire replacement, $532.74, of which at least $150 remains in the present tires	150.00
For general repairs, $355.16, of which $174.93 has not been used up	174.93
Total reserve	$741.53

"In the total cost of operation is included the item of $903.50 for helpers for loading and unloading, which amounts to 20.15 per cent. of the total charges. The actual operation of the truck, not included in the helper's charges, amounts therefore to $18.05 a day, 39.33 cents a mile, $1.17 a ton, 9.5 cents a ton-mile."

LEGISLATION TO LIMIT WEIGHT OF TRUCKS.

THE New York State Automobile Association, an organization composed of American Automobile Association clubs, and representing a very small proportion of the owners of automobiles in New York, has announced that it will exert its influence in securing the passage by the legislature at the 1914 session of legislation that will "preserve the highways." Very recently the secretary of the association, Robert S. Ross, stated that it was the intention of the body to take an active part in legislation, and that it was the purpose of those directing its activities to attempt to limit the weight of the truck and the load to three tons, and to require tires to be of a width proportionate to the maximum weight to be carried.

Mr. Ross is quoted as saying: "Under present conditions it looks as if the roads or the motor trucks would have to go. In all probability the motor trucks will force the construction of more permanent types of roads, but until that time comes, motorists generally feel the macadam roads should be protected."

It will be noted that, if the statements correctly reflect the purposes of the pleasure car owners represented by the association, the intention is to ask that the weight of the vehicle and load be limited to 6000 pounds, and that these be fitted with tires of adequate width. To take these statements literally it will be understood that the association proposes to prevent the use of freight machines that are much heavier than the heaviest types of passenger cars. This is not an extravagant assertion, for many of the large automobiles will weigh close to 4000 pounds, and with the load of from five to seven passengers the weight will increase as much as 1000 pounds additional, leaving but a margin of 1000 pounds between the maximum weight of the touring car and the freight motor wagon.

But these machines can be and are very frequently driven far in excess of the limits prescribed by law, and naturally the greatest speed is made over the best sections of highway. The maximum speed of the well built and well designed light motor delivery wagon is from 14 to 16 miles an hour; the maximum of the three-ton truck is 12 miles, and of the five-ton truck from nine to 10 miles when driven light, and somewhat less than these figures when loaded.

The best authorities on road construction are united in the opinion that the motor vehicle driven up to 15 miles an hour does not cause more wear of the surface of a road than does an animal cart or wagon, and it will be admitted that the average speed of motor trucks is considerably less than this, a fact that is especially true of the larger machines.

There are some facts relative to road construction that may not be apparent to the average citizen, and one of these is that a water bound macadam road will not endure under combined horse and motor vehicle traffic. A tar macadam will last for a long time under motor driven traffic alone, and a gravel road will stand combined horse and motor travel better than macadam, because the roadbed is consolidated by the wagons and machines passing on it.

The proportion of automobiles to trucks in New York is about 10 to 1, and a considerable number of the service wagons are electrics, which have a maximum speed of from seven to 12 miles. With comparatively few exceptions these are worked in the cities. Probably 10 per cent. would be a fair statement of the number used constantly on the state highways. Assume this number to be 1500, and the average speed 12 miles, and place against this the 100,000 or more machines that are largely used on the roads, driven at high speed as often as the drivers care to take a chance, and contrast the possibilities of wear of the highways from either source.

Before the use of automobiles became general the owners of horses maintained they were the only ones who had rights in the streets and roads. It was chiefly this opposition to automobiles that caused taxation of the machines. The motorists would have been driven from the roads had the majority been successful in its opposition to the automobile. The nonsensical argument was made that the automobile was destructive of highways and its use was accompanied by all sorts of results, some of them menaces to health as well as to persons and property.

Now the automobilists, or some of them, have assumed identically the same attitude as did the owners of horses, and in some instances those who owned no vehicles, and maintain that the motor trucks should be limited to proportions so small that their usefulness would be nullified. But there is another aspect as well. If such a law should be enacted those who now own machines that would be prohibited their use would necessarily be deprived of their property, and as these have been purchased without limitation or restriction as to size or weight, there would necessarily be recompense made to them. In other words, the law could not be made retroactive without providing compensation for those who were prevented using the trucks.

Then arises the subject of tires. Just what sizes would be necessary or desirable on vehicles of differing weights have never been determined conclusively. Tire size has been largely a detail of design and no standards have ever been adopted by any body. The Society of Automobile Engineers has reached no conclusions as to tire width, and this is regarded as the authoritative body of the industry. There appears to be no necessity of specifying tire sizes for pleasure cars, such as are owned by those who have seemingly endeavored to eliminate the motor truck from the highways, and there does not seem to be a need for so constructing cars that they cannot be driven beyond a speed that is not destructive of the road surfacing. There is no doubt, however, that either proposition would be equally logical.

In Providence, R. I., there is agitation by some of the city council of a proposal to enact an ordinance

regulating the size and weight of the motor trucks used in the street. It would appear that the agitation is the outcome of the establishment of a couple of motor 'bus lines that have been operated from the centre of the city to Cranston and East Providence, and seemingly has emanated from the transportation company operating the trolley system, for the man who is active in promoting the proposition has been energetic in all public matters involving this company and its interests. It is maintained that the 'buses are too wide, when as a matter of fact they are narrower than the trolley cars. This appears to be the only objection to them.

The objection to some of the motor trucks used in the city streets is that some of them are too wide for the streets, and that they are too heavy and are destructive of the street surfacing. There are several seven-ton machines and a considerable number of five-ton trucks, but without exception these are fitted with bodies such as are used in other cities without protest. What is probably as asinine an argument as was ever stated, is that these machines are an inconvenience or source of discomfort to those having homes or offices in the streets.

In the business section of Providence there are few wide streets, for the highways were laid out in some instances more than two centuries ago, and a considerable number are 30 feet wide. The majority of these have been made one-way streets, however, and this congestion relieved. There are also numerous private ways between buildings and properties that are generally not more than 10 feet width, and while these are commonly used, the city has no jurisdiction over them. The proposed legislation, then, can only apply to highways that appear to be especially well regulated, and where the trucks are not generally used.

That there will be legislation purposing to increase the rate of taxation and limiting the weights of trucks used in the state introduced into the next session of the Massachusetts legislature there is not the slightest doubt. The chairman of the state highway commission, who has for two years been the leading sponsor of such measures, has been actively promoting a campaign of preparation since the adjournment of the legislative session. He has lost no opportunity to urge publicly that the owners of machines ought to pay a tax in addition to what they now pay, and that there is a limit to his mind as to the weight of the vehicle and load. The alleged weakness of a few bridges is the basis of his argument.

There is now no law that specifies the weight of a road vehicle of any kind, and until the chairman of the highway commission discovered the weakness of the bridges no danger was apprehended. There are laws, however, that require that roads be maintained passable and safe for such vehicles as are used upon them, and these are applied to all highways that are not under the jurisdiction of the state highway commission. The bridges in the state system, which is supposed to include the main thoroughfares of the commonwealth, are to be maintained by the commission, and if, in improving the roads and modernizing them, the commission has neglected to correspondingly improve the bridges, this neglect does not appear to be a valid reason for denying to the business men of the state and the adjoining states the right to use vehicles that will be efficient and economical.

In Massachusetts the same organizations that successfully opposed the passage of the bills at the last session of the legislature are awake to the possibilities of the activity of the commission, and the men active in them propose to know the attitude of every candidate for election. Those who are favorable to measures such as are favored by the commission will undoubtedly be opposed at the polls.

CARE OF BALL BEARINGS.

New Departure Manufacturing Company Issues Book of Valuable Suggestions.

Bearings in a motor car are most important components and the aim of the designer is to eliminate all friction and thereby avoid loss of power, a decided factor in the operation of a car. The repairman is often called upon to replace, adjust and clean ball bearings and the work requires a thorough knowledge of the construction and operation of the bearing if satisfactory results are to be obtained.

The New Departure Manufacturing Company, Bristol, Conn., maker of New Departure ball bearings, has compiled a manual which should be in the possession of every mechanic, repairman and operator of a commercial vehicle. It contains valuable suggestions for the best methods of removing and installing ball bearings, their lubrication and enclosure. The importance of proper maintenance, including cleaning, is defined, and a large number of illustrations make clear the points emphasized.

The book is written in a clear, concise manner, free from technical expressions, all explanations being couched in such simple language as to be easily understood. The brochure also contains description and dimension data on all types of bearings made by the company. The book will be sent free of charge by applying to Department M of the New Departure Manufacturing Company, Bristol, Conn.

The first of three KisselKar trucks made by the Kissel Motor Car Company, Hartford, Wis., purchased for freight and passenger traffic in the Ozark mountains of Missouri, has been delivered and placed in service. This machine operates between the towns of Houston and Cabool, a distance of 20 miles over difficult hills and unimproved roads. One round trip every day is made. Another truck will be used on the same run, so as to make two daily trips possible.

The White Company, Cleveland, O., in one week sold three orders that totalled 81 machines.

Municipal Service Equipment

CLEANS OUT CATCH BASINS.

Standard Truck Replaces Six Teams and 12 Men in This Class of Service.

The city officials of Pawtucket, R. I., or more properly speaking, Commissioner Gill of the department of public works, has devised a plan whereby a three-ton Standard truck, made by the Standard Motor Truck Company, Detroit, does the work of six-horse carts and 12 men in cleaning out the catch basins of the city. Not more than three men are required to work the truck and accomplish the same results.

The chassis does not differ materially from that regularly supplied by the maker. The body was built by the Monahan Vehicle Company, Providence, R. I., and embodies some of the ideas presented by Commissioner Gill. The entire outfit is designed to lower buckets into the sewer basin, there to be filled and then hoisted and dumped into the body of the vehicle. When the latter is filled, the machine is arranged to dump the entire load in 40 seconds, so that there is a material saving in time, as well as labor.

Directly back of the driver's seat is a two horsepower single-cylinder auxiliary engine, geared to a hoisting drum from which a cable is run through the centre of the crane and over pulleys on the arm. This engine draws its fuel supply from the same source as the regular motor which propels the truck, and the exhaust is arranged to communicate with the muffler. The water circulation is connected with the radiator, so that the two engines utilize practically the same system. At the front of the body is an hydraulic hoist for dumping the load, this comprising a long cylinder with a piston forced upward by oil from a gear pump, which is driven by a connection in the transmission case.

The mechanical details were worked out by James Nesbit, who is in charge of the motor apparatus utilized by the department of public works, and although the machine has been in service but a few weeks, the city is satisfied that its use will represent a very decided saving in expense, when compared with horses in this line of work.

ITS FIRST PUMPING ENGINE.

Fire Department in St. Paul, Minn., Has Highest Powered Machine in the State.

The city authorities in St. Paul, Minn., have purchased its first motor pumping engine of the Waterous Engine Works Company of that city. The machine was rated to deliver 700 gallons a minute, but in a two-hour test it delivered 840 gallons. The engine ran remarkably well, without any perceptible vibration. It is a six-cylinder machine and is said to develop 101 horsepower, making the machine the highest powered automobile fire engine in the state.

The vehicle has a 141-inch wheel base and is capable of making a speed of 50 miles an hour. It weighs 12,175 pounds with equipment and is arranged to carry 12 men, or, with the seats folded, 2000 feet of hose.

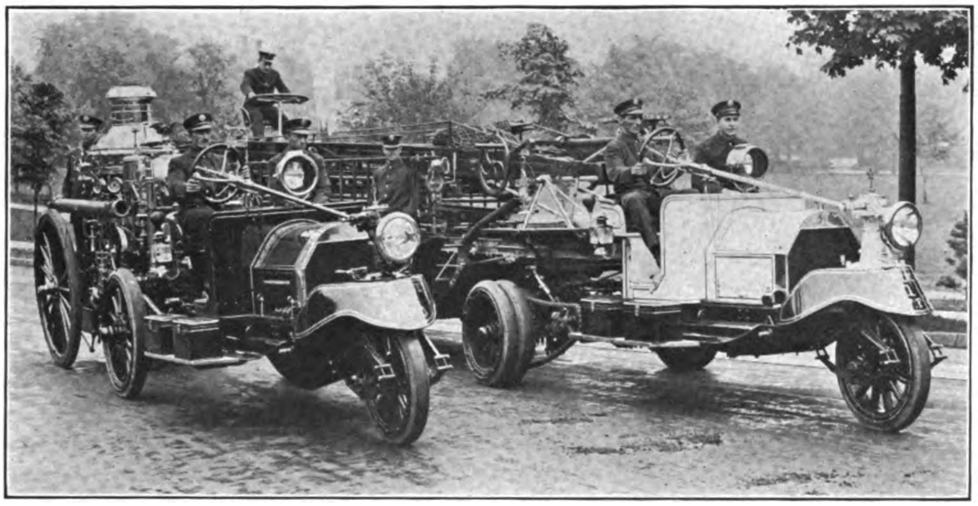
A Standard Three-Ton Chassis Fitted with Crane and Hoisting Engine, and Special Dumping Body for the Service of the Public Works Department, Pawtucket, R. I.

It has an electric motor starter and the machinery underneath is lighted by electricity. A stream from a 1.5-inch nozzle can be thrown to a height of 210 feet.

SAVING TWO DOLLARS A DAY.

Two Knox-Martin Tractors Will Soon Pay for Themselves in Mt. Vernon, N. Y.

One of the first Knox-Martin tractors made by the Knox Automobile Company, Springfield, Mass., was installed with the fire department in that city on a contract under the terms of which the city was to have a full year in which to test its economy and efficiency. The machine was attached to a water tower, which had proven too heavy for horses, and which, for this reason, was not kept in active service. Before the year was up the city had purchased the vehicle, it having been demonstrated in one fire alone that it was advisable to have the water tower in constant service and that the tractor was the proper means of propelling it. The city has now purchased a second vehicle of the same make, for use with one of its hook and ladder trucks.



Two Knox-Martin Tractors Utilized by Fire Department in Mt. Vernon, N. Y.

Herewith are presented two pieces of apparatus owned by the fire department in Mt. Vernon, N. Y., one a steam fire engine and the other a large hook and ladder truck. The latter has a double equipment of ladders and therefore presented a problem similar to Springfield's water tower, in that it was found exceedingly heavy for horses. The purchase of the two Knox-Martin tractors made necessary but very little rebuilding in order to make this portion of the department motor driven.

When the horses were employed the cost of the two pieces was figured at $72 a month. Motor driven, the expense has been less than $2 a month each. This leaves a balance of $68 a month, or a little better than $2 a day, in favor of the Knox-Martin tractors. And, of course, the limited cost of converting the two pieces was an item of no small consequence in considering the proposition in the first place.

HARTFORD'S SELF-PROPELLER.

Department Lays Claim to Having Oldest Apparatus of This Type in the Country.

Hartford, Conn., lays claim to the oldest piece of self-propelled fire apparatus in the country, the old "Blake seven" engine, a spare propeller which has been in service for 37 years. Officials of the fire department state that Hartford is the only city in the country which has had a self-propelled apparatus for so long a period. Other cities purchased propellers 40 years ago, but their use was abandoned at different times and the horse driven apparatus was used again until the introduction of the gasoline motor several years ago.

The "Blake seven" propeller was purchased by the city of Hartford in 1876, and was delivered in March of that year. It was manufactured at the Amoskeag Locomotive Works at Manchester, N. H. It was assigned to old engine company No. 7 and Augustus J. Loomis, now chief of the department, was the first engineer. The machine has always been satisfactory and its construction was so good that it was rebuilt only once, although minor repairs have been made at various times. The apparatus was transferred to company No. 4 in 1889. It became a spare engine on Aug. 22, 1901, and has been used in that capacity since that time.

The engine weighs between five and six tons and its pumping capacity is 700 gallons. It cost $5000. The city has had three steam propelled fire engines. The second machine was purchased second hand from Troy, N. Y., in 1879, and was later turned in in part payment for the machine now in use by company No. 4, which weighs 18,000 pounds and cost $7500. The propeller used by company No. 3 was purchased in 1889 at a cost of $7000 and was rebuilt in 1908, when a new boiler was installed. These two machines made it possible to retire "Blake seven" as an auxiliary machine.

BUYS FIFTEEN MACHINES.

Pittsburg Expends $100,000 of a $240,000 Bond Issue for Motorized Fire Department.

Pittsburg, Penn., has testified its faith in the automobile as a fire fighting machine by a number of new contracts just placed by the mayor and the director of the department of public supplies. These contracts involve an expenditure of $100,000. The new equipment and the successful bidders are as follows: Ten

combination chemical and hose wagons, $4500 each, American-La France Fire Engine Company, Elmira, N. Y.; one 75-foot aerial ladder truck, Knox-Martin tractor, $8550, Seagrave Company, Columbus, O.; one 85-foot aerial truck, Knox-Martin tractor, $8950, Seagrave Company; two tractors at $3250 each, and an automobile for chief engineer at $3550, to General Automobile Company.

The contracts are in accordance with a recently publically approved bond issue of $240,000 for automobile fire fighting apparatus. It is the policy of the present city administration to motorize the entire department and 50 per cent. of the fire equipment is now motor driven. The hilly topography of the city has been an important factor in inaugurating this policy and the result has been eminently satisfactory.

BATTERY DRIVEN FIRE ENGINE.

Maintenance Cost and Work Done During First Year of Service in New York City.

The only storage battery driven fire engine in New York City has been under test since April, 1912, in one of the up-town fire houses of Brooklyn. The annual maintenance expense for the first year was $388.74 as compared with $655.26 for a team of three horses which hauled the same machine previously.

In making the conversion to motor apparatus an engine was used that had been 10 years in service. A steel frame was built forward from the boiler and to this were mounted the driving gear and controlling apparatus, consisting of two Couple-Gear wheels, the usual steering devices and a controller similar to the equipment of a trolley car. An 80-cell storage battery completed the installation. Thus engine 217 became a straight electric machine as far as its motive power was concerned and remained a standard fire engine with respect to its pumping and fire fighting ability.

Before it went into service it was put through a series of speed trials in which it made a six-mile run through the city streets in 23 minutes, on one stretch developing a speed exceeding 20 miles an hour, while a hill nearly a mile in length was negotiated in 2.5 minutes. A recent report of its service showed the following:

From April 24, 1912, to April 24, 1913, the engine responded to 319 alarms. Some of the runs were short, others were more than a mile from the house, and although no record was kept to show actual distances, a mile run for each alarm is considered a fair average.

During this period there wasnot a single instance of damage to the electrical equipment, although street accidents and repairs to the mechanical parts necessitated 64 hours in the shops for replacements, a feature that is encountered in fire apparatus as well as in other kinds of engines and machines. More than 14 hours were spent at fires and approximately 230,000 gallons of water were pumped.

To reconstruct the engine cost the department $4000. As the apparatus now stands it has an estimated life of 20 years; so, figuring on a five per cent. basis, $200 a year is allowed for depreciation. Added to this is the cost of charging, the rate being six cents a kilowatt-hour; 1965 kilowatts were used in responding to a year's fires, so the current bill amounted to $117.90. Distilled water and sulphuric acid for new electrolyte, brushes for the motor and other repairs added $70.84 to the bill, bringing the total cost for the 12 months operation to $388.74.

Three fire engine horses, their harness, the hangers and the ceiling apparatus for dropping it over their backs costs the department $1059.75, and new animals and equipment are required every 10 years, making the item for depreciation $105.98. It costs $410.82 to feed three horses, horseshoeing costs $85.04 and veterinary service $21, and added to this is $32.42 for sundries, bringing the total cost to $655.26.

These figures show a difference of $266.52 between the two types of motive power, and while that difference is impressive enough, it is the feed item that shows most strikingly the real reason for the higher cost of maintaining a team of horses. It costs $410.82 to feed the animals, and the cost remains the same if they go to but one fire during the whole year or respond to an alarm every day. During this particular year the electric engine went to more than 300 fires and the bill for "feeding" the storage batteries was $117.90. Had there been but one fire the "feed" bill would have been in the neighborhood of 30 cents.

NEWS FROM VARIOUS CITIES.

Stewart for Water Department—The purchasing agent of Lowell, Mass., has selected a Stewart motor truck, made by the Stewart Motor Corporation, Buffalo, N. Y., to be used by the water department of that city. The machine cost $1725 with equipment.

New Bedford Adding Equipment—New Bedford, Mass., has decided to purchase two pumping engines of the Ahrens-Fox Fire Engine Company, Cincinnati, O., and the Robinson Fire Apparatus Company, St. Louis, Mo., and also a 30 horsepower Buick car, made by the Buick Motor Company, Flint, Mich., for the fire chief. A total special appropriation of $23,000 is made, $18,000 being for the pumping engines, $1900 for the chief's car, and $3500 for the extension of the fire alarm system.

Nine Miles in 17 Minutes—Joseph Johnson, fire commissioner of New York City, recently travelled from 189th street and Audubon avenue in a fire department automobile to Wooster and Centre streets in 17 minutes, going through the heavy traffic of Broadway in answer to a three-alarm fire call. The blaze was in the seven-story loft building at 179-183 Wooster street and did $100,000 damage before it was checked. Mr. Johnson was in a fire station on Washington Heights when the three alarms were sounded for the fire nine miles away. It is said to be the quickest time in which the distance ever has been made.

Truck in Mining Work—A large automobile truck soon to be added to the equipment of the United States bureau of mines at Pittsburg, Penn., will serve the same purpose as the railroad mine rescue cars. It will carry a small complement of men, oxygen helmets and rescue apparatus. While the railroad rescue cars are used for long runs, the motor truck is designed chiefly for use in territory within 100 miles of Pittsburg.

In the Market—The following cities are contemplating the purchase of motor apparatus: Georgetown, N. C.; Livingston, Mont.; Iowa City, Ia.; Clinton, Ia.; Ashland, Ore.; Anaheim, Cal.; Alameda, Cal.; Taft, Cal.; Weatherford, Tex.; Wichita Falls, Tex.; Richmond, Va.; Champaign, Ill.; Council Bluffs, Ia.; Winston-Salem, N. C.; Morristown, N. J.; Milford, N. H.; Grinnell, Ia.; Richmond, Ind.; Southbridge, Mass.; Albuquerque, N. M.; Findlay, O.; Pasadena, Cal.; Springfield, Mass.

FOREIGN TRUCK NOTES OF INTEREST

LEYLAND PUMPING ENGINE.

Interesting Machine Built in England for Fire Department in Shanghai, China.

An accompanying illustration presents a 55 horsepower pumping engine built by the Leyland Motors, Ltd., Leyland, Lancashire, England, for the fire department in Shanghai, China, and effectually dispels the illusion formerly created by published pictures of Chinese firemen rushing through the streets dragging a hand cart. This machine is thoroughly modern in every respect and reflects the progressiveness of the newer China.

The chassis is the standard gasoline model produced by this concern, although the company perhaps is quite as well known as a manufacturer of steam commercial vehicles, in which it has been engaged for many years. The motor is a four-cylinder unit, with bore of five inches and stroke of 6.5, being rated at 55 horsepower. This not only propels the machine, but drives the Rees-Roturbe rotary pump through a geared layshaft from the top of the transmission casing. The pump is of the four-stage centrifugal type and has provision for taking three lines of hose. It is rated at 450 gallons a minute.

Leyland Gasoline Pumping Engine, with Rated Capacity of 450 Gallons, for Service in Shanghai, China.

TWO MAUDSLAY CHASSIS.

Features to Which Special Attention Was Directed During the Olympia Show.

Among the exhibits at the recent motor truck show at Olympia, London, England, which called for special comment by the British motoring prints, were the chassis displayed by the Maudslay Motor Company, Ltd., Parkside, Coventry, England, well known as a manufacturer of both pleasure and commercial cars of merit. Two chassis were displayed, these being rated at three and five tons, respectively. An accompanying illustration presents the Maudslay char-a-banc, fitted to the lighter of these.

The three-ton chassis utilizes a four-cylinder motor rated at 30-40 horsepower, the bore being 4.5 inches and the stroke five. The cylinders are cast in pairs, the valves being overhead, actuated by a camshaft, worm driven from a vertical shaft arranged at the right hand forward end of the engine. Cooling is by the thermo-syphon system. The carburetor is of special design, with 12 jets, which are covered when the throttle is closed by means of a sliding saddle incorporated with the barrel throttle. As the hand actuated lever above the steering wheel, or the accelerator pedal, is operated the throttle is slid along and exposes one or more of the jets, at the same time admitting more air by a passage below the throttle. In this way it is maintained that the mixture is preserved constant, whatever the speed of the engine.

The clutch is of the leather-to-metal cone type, enclosed and running in oil, and a clutch stop is fitted at the rear. The transmission affords three forward speeds and reverse. The rear springs act partially in the capacity of torque rods, but there is an additional torque and radius rod, spring controlled, which takes up any hard shocks which may be transmitted by the drive. This chassis is worm driven.

The motor on the five-ton machine also is a four-cylinder unit, with bore and stroke of five inches. In all other respects the larger chassis is identical in design with the smaller, with the exception of the rear axle and drive. This is termed a double reduction gear driven live axle of the bridged type. The Maudslay company claims to have been the first to introduce the bridged rear axle in Great Britain, at least for heavy loads. The whole of the load is taken on a solid forging, and the transmission gears, shafts, etc., may be withdrawn without the use of jacks or other extraneous aids. All Maudslay models are fitted with readily detachable cast steel wheels.

The 28-passenger char-a-banc shown was made to special order for P. Eastwood, Burney, Colne, for pub-

lic service work, the body being by Buckingham. This is of the so-called torpedo type, which has met with such ready acceptance by the British public. A special feature will be found in the arrangement of the doors, which open on either side alternately, the idea being to provide a stiff body construction.

FRENCH MILITARY TRIALS.

Gaulois Tires Very Prominent as Equipment on Competing Machines This Year.

The French military trials for trucks and tractors, which ended recently, is a 25 days' endurance test of commercial vehicles liable to be commandeered by the army in time of war. These tests have been conducted annually since 1909, and the prizes are in the nature of a subsidy, clean score machines carrying a dead load of 4500 pounds being awarded a purchase premium of 2000 francs, and those carrying a dead load of 17,500 pounds a purchase premium of 6000 francs. In addition, the winning trucks and tractors are eligible for a maintenance allowance of 1000 and 2000 francs a year respectively, for four years.

Each truck is accompanied on its journey across the country by a commissioned officer of the army, who must file a daily report of the performance of the machine under his observation. The dead weight carried is made up of small cases filled with broken stone, each weighing 100 pounds. The average speed imposed by the schedule is 10 miles an hour, and no vehicle is permitted to exceed 15.

The importance of the event has grown each year. In 1909, the entrants numbered 57, of which nine finished with perfect scores. In 1910, 36 entered and six finished. In 1911, there were 58 entries and 19 finished, while in 1912 there were 76 entries and 20 finished. This year, 98 trucks and tractors took part in the contest, the entrants including the following makes: Renault, Panhard-Levassor, De Dion-Bouton, Rochet-Schneider, Berliet, Saurer, Brasier, Clement-Bayard, Lorraine-Dietrich, Delahaye, Motobloc, Aries, Peugeot and Latil. Ninety-seven of the 98 were mounted on rubber tires, and 78 per cent. utilized those of the Gaulois make, represented in this country by the Gaulois Tire Corporation, 1926 Broadway, New York.

COMPETING WITH RAILROADS.

London Times Discusses the Subject Editorially, Citing Some Interesting Examples.

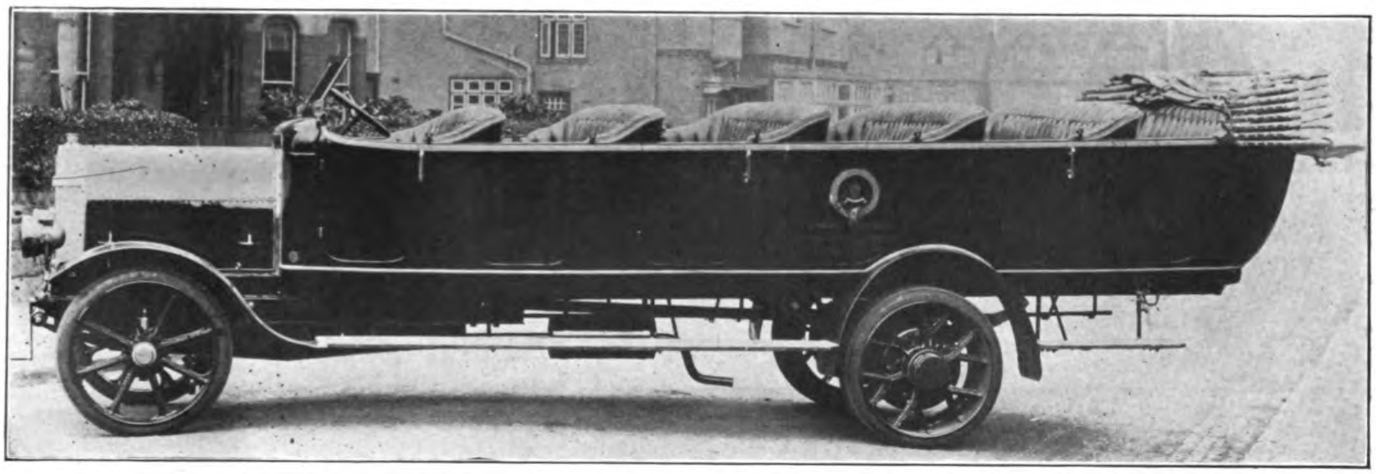
Transportation of freight and merchandise by motor truck in England has assumed such proportions that the railroads recently raised their freight rates, which step has naturally added to the popularity of motor truck transportation. The recent announcement at Los Angeles, Cal., that merchants there had combined to operate a motor truck line between that city and its nearby seaport, in competition with existing railroad service, indicates a repetition in the United States of conditions existing in England. Discussing the matter editorially the London Times in a recent issue said:

In the north of England there are cases even in the neighborhood of well managed railways in which considerable trade is being done between the collieries and wholesale distributing coal merchants by road, and more and more coal is being taken direct from the pit's mouth to the distributor and consumer without the agency of the railway truck.

In addition to this coal trade, in the neighborhood of Manchester and Liverpool, and all over the centre and south of Lancashire, elaborate arrangements have been in operation for some time past by which the cotton is taken up from the seacoast to the spinning mills and thence to other mills, where it goes through other processes, and eventually the manufactured goods are taken back, either to the seacoast for shipment or to a distributing centre like Manchester.

Other trades are now organizing road transports, and market gardeners, laundrymen and men of all the various trades which spring up on the outskirts of a great city are not only discarding their horses, but are now giving up the use of railways for the conveyance of their goods.

Some of the larger firms in London, such as Harrod's, Selfridge's, the Army and Navy stores, Maple's and others, now send out the majority of their goods within 100 miles' distance of London by road; and every year sees a comparative diminution in the proportion of goods and parcels sent by railway. It is clear, therefore, that any higher charges made by the railway companies must stimulate this existing tendency. Makers of commercial vehicles report excellent business, and we hear that firms of producers and distributors are contemplating a large addition to their road motors.



Maudslay 28-Passenger Char-a-Banc of the Torpedo Type, Fitted with Worm Driven Rear Axle of So-Called Bridged Design.

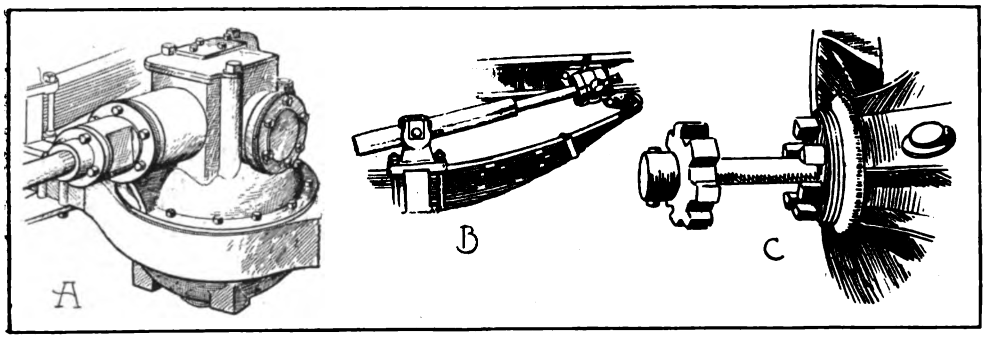
GENERAL NEWS FROM ABROAD.

Opportunities in Portugal—There appears to be a demand in Portugal for commercial motor vehicles, which will probably grow rapidly. At present there are about 30 motor delivery wagons and trucks in use

in Lisbon and 11 motor trucks and one motor delivery wagon at Oporto. German manufacturers have supplied the market to a large extent, but French and Italian makes are represented.

New German Traffic Regulations—Several important modifications have been made in the German motor traffic regulations, the Bundesrat having apparently concluded that automobiles should be constructed to suit the roads. The main modifications are the abolition of the iron tires and the restriction of axle weights and rim pressures. The section which required owners to fit rims with "smooth rims not calculated to damage the road surface," now provides that "rims should be shod with rubber or other elastic material and possess no unevenness likely to damage the roadway." The regulations also forbid the weight upon any axle to exceed six tons when a vehicle is loaded, and the pressure a centimeter of rim width is not permitted to be more than 743 pounds to each inch of width.

Overland in England—A new concern incorporated at London, England, is the Willys-Overland, Ltd.,



Constructional Details of Maudslay Chassis: A, Double Reduction Gear Casing; B, Spring Torque and Radius Rod; C, Rear Wheel Drive and Method of Withdrawing Live Axle Through Hub.

with an authorized capital of $50,000 in $5 shares. The incorporation is for the purpose of manufacturing and dealing in all kinds of passenger and commercial automobiles and the first directors are John N. Willys and Claude A. George. This firm will be the English branch of the Willys-Overland Company, Toledo, O., maker of Overland cars, of which John N. Willys is president. The truck firms controlled by the concern will be represented in the English market by the company.

Situation in South Africa—A great deal of attention is being given at present in South Africa to the use and suitability of motor tractors for farming operations. One of the largest land owners and agriculturists in the Transvaal conveys the information that in order to plow land deep and get moisture into the soil early it is necessary to have some system of kerosene plowing. He stated that the system of plowing with oxen, as is universally the case there, is cheap but slow, and by this process the land cannot be broken in the winter months as the ground is too hard, owing to the dryness of the atmosphere and the winds. Thus the advantage of the mechanically driven plow. There are numbers of farmers who would pay to have new land broken deep, but there is no system of doing it, and as, beyond a few steam plows, there are no examples upon which to work, no general movement for traction plowing has been inaugurated. The field promises much to manufacturers who enter and open it up.

Mining Work in Australia—There appears to be demand for one-ton tipping wagons in the mining districts of Australia. At present railroad cars are loaded in the mines, the contents being transferred to animal wagons at the completion of the run. Investigation of the possibilities with motor vehicles has indicated that they could be operated within the mines, thus eliminating the necessity for the second handling, with much saving in time and expense.

Possibilities in Spain—Since motor cars have come into more general use in northern Spain, there has arisen a demand for commercial vehicles. There are said to be excellent openings in Galicia and Asturia, providing the business is placed in the hands of a capable agency. In constructing cars for this market it should be borne in mind that the gasoline sold there is not very pure, and has a tendency to work great harm to the engines. The road conditions are now particularly good.

Want Trucks in Ceylon—The Morawakorale Planters' Association on the island of Ceylon has requested Charles P. Hayley & Co., to operate a service of motor trucks in that district. It is further announced that if this concern does not find itself able to take up this work, an effort will be made to secure a suitable contractor to take up the work, by advertisement.

Taxicabs in Japan—The success which has attended the establishment of a taxicab line in Tokio, Japan, has resulted in the proposition to start a similar service in Kakata, in the prefecture of Kukuoki.

No Steel Tires in Paris—The prefect of police in Paris, France, has issued an order that on and after Oct. 15 no heavy duty motor vehicles with steel tires shall be operated within the city limits. In addition, the speed limit of all commercial motor vehicles has been fixed at 7.5 miles an hour.

Opportunity in Colombia—A road making contractor in Bogota, Colombia, is making inquiry concerning motor trucks, having requested catalogues and other information concerning various machines from consular agents in that city.

THE A B C OF MOTOR TRUCK IGNITION.

Part XIII---Classifying the Various Types of Magnetos and Outlining Their General Characteristics---Construction and Operation of Inductor Designs Employing Stationary Windings and Produced in Both Low and High-Tension.

By C. P. Shattuck.

MAGNETOS utilized for ignition purposes may be divided into two general classes, high and low-tension, and these may be sub-divided into three types, namely: Double or compound armature (true high-tension), single and inductor (low-tension). With true high-tension magnetos the production of the primary current and its transformation into high-tension, is performed by the instrument itself, the armature carrying two windings, a coarse and a fine. With this type the exterior wiring is greatly simplified, there being but one wire in addition to those conducting the high-tension current to the plugs, and this is utilized to control the flow of electricity. There is no coil or transformer employed.

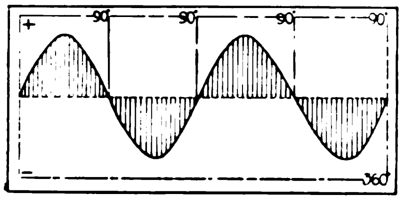


Fig. 67—Current Waves of K-W Magneto.

Magnetos having a single winding and employing a transformer coil to build up the low-tension current are also designated as high-tension, a term somewhat misleading to the novice. The coil utilized for building up the low voltage current so that it will bridge the gap at the spark plug points, or in other words, overcome the air resistance, is also called a step-up coil. These may be of a vibrating or non-vibrating construction, and as the principles involved are the same as those utilized in the induction coil, their operation will be understood fully by the reader. The third class of magnetos is the low-tension, that acts simply as a source of current, and is used in connection with a vibrating coil and a timer in the jump spark system of ignition. This type may be driven by friction, belting, etc., and with it the timing of the motor is not considered, as the speed of the magneto is in excess of that of the engine's crankshaft.

Inductor Magneto.

The inductor type of magneto differs from the armature construction in that its windings remain stationary in operation, the rotors or inductors revolving. The inductor may be one of two forms, a low-tension, having but one winding of coarse wire and employing a step-up coil or transformer, or a true high-tension, as in the case of the K-W.

Certain elementary parts of an inductor magneto are shown at Fig. 68, as well as the position of the driving shaft and inductors at different portions of a revolution. The upper drawing shows the magneto as it would appear with the end plates displaced, the lower illustrations depicting sections along the line X-Y of the corresponding drawing above them. But two magnets are shown, although there are more in a practical magneto because a series will supply more magnetic flux or energy than a single pair. These are securely fastened with all the north poles against the pole piece N, and all the south poles against the pole piece S. These are iron, but the base is brass. If an iron or steel base were utilized, part of the magnetism would pass through it instead of taking the proper course through the winding.

Construction of Inductor, Etc.

The stationary coil or winding is retained by the pressure of the pole pieces against it and by a clip. Two inductors are mounted on the shaft and rotate with it. To provide a path for the magnetic force, the inductors, core and shaft are composed of magnetic material. The direction of the magnetic flow through the revolving parts is shown by the arrows, the full ones indicating the path through the visible parts, the broken ones marking out the course taken through a normally invisible component.

In position A, the front inductor is adjacent to the pole piece N and the rear inductor is close to S. An iron path is formed between the inductors by the metal shaft and core. The cross section of the shaft is not large enough to carry all the magnetism, so the core assists by carrying part of the flux. The magnetism thus passes from the pole piece N to the front inductor, through the core and shaft to the rear one and thence to the pole piece S. The magnetism passes through the coil in this instance from front to back.

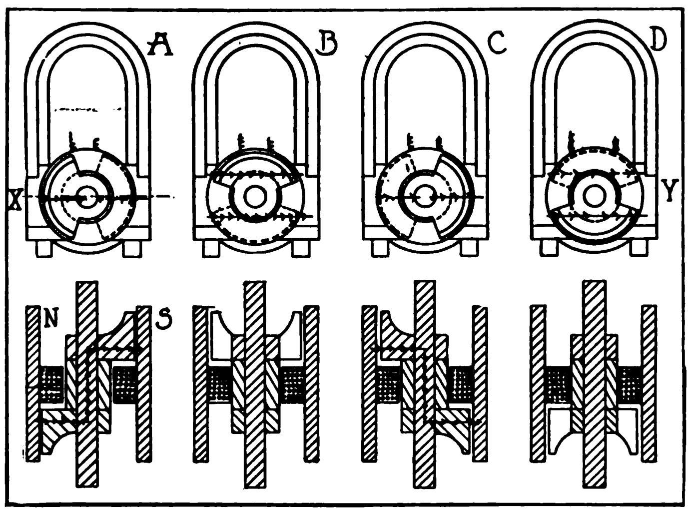


Fig. 68—Principles of Inductor Magneto.

In position B, the inductors are so placed that each one forms a path between the pole pieces N and S, and

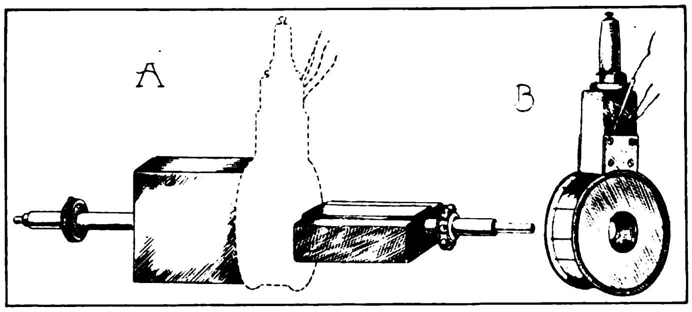


Fig. 69—Components of K-W Magneto: A, Rotors and Phantom View of Stationary Winding; B, Winding of Primary and Secondary Wires.

the magnetic force does not pass through the coil because of the shorter path provided by the inductor assembly. In position C, the conditions are similar to those shown at A, except that the flow of magnetism is reversed, passing through the coil from back to front. When the components are as shown at D, the same effect is obtained as at B, except that the front inductor is down and the back one up. In this position no magnetism passes through the coil.

It will be seen that as the inductors revolve the amount of magnetism passing through the coil is continually varying, thereby inducing in the winding an electromotive force, which is reversed twice during each revolution, when the inductors pass the positions A and C. As long as the direction of the magnetic flow remains the same, increasing and decreasing flow induces electromotive forces in the winding having opposite directions. Increasing magnetism in one direction and decreasing flow in the opposite path induces a current having the same course.

K-W Rotors.

At Fig. 67 is presented the shaft, rotors and windings utilized on the K-W high-tension magneto, a sectional view of which is indicated at Fig. 70. The rotors are constructed of fine laminations of soft Norway sheet iron riveted together and bored out to fit the rotor shaft. They are mounted at exactly right angles to each other, as shown in the drawing. The windings, which are shown at B, are concentric with the armature shaft, are mounted between the two halves of the rotor indicated by the phantom view at A, and remain stationary. These rotors collect the magnetism from one pole piece and conduct it through the centre of the winding to the opposite pole piece, producing a wave current each quarter revolution of the shaft. The winding shown at B is double; that is, it comprises a primary or coarse winding (low-tension), surrounded by a fine winding (high-tension).

The primary or low-tension energy produced by the revolving of the rotors as explained, is led to the circuit breaker, where its flow is interrupted, inducing a high-tension current in the secondary winding, which is conducted to the distributor, thence to the spark plugs. With the K-W magneto the condenser is bridged across the circuit breaker points, its function being to absorb the low-tension spark at the breaker points, caused by the interruption of the primary current. The safety spark gap was explained in the previous installment.

By referring to Fig. 70 the path taken by the primary and secondary currents may be traced. It will be noted that there are two wires leading from the stationary winding shown at Fig. 69 B. The secondary current passes upward vertically through a hard rubber terminal member to a bus bar, thence by an insulated high-tension lead to a brush and the distributor block, retained by a three-legged spider or bridge. The primary current flows through this bridge on its way to the circuit breaker, which carries a terminal to which is secured the wire leading to the switch, thence to the ground.

This lead is utilized for stopping the motor, as by closing the circuit the primary current generated by the magneto is diverted from the secondary winding, flowing through the wire to switch, thence to metal or ground. The circuit breaker mechanism and the distributor operate in the conventional manner.

The K-W magneto can be adapted to provide either one, two or four sparks a revolution of its armature shaft, as four current waves are produced each revolution. The difference in the construction of the cams is shown at Fig. 71, that at B being utilized for single, two and three-cylinder, four-cycle motors, while that

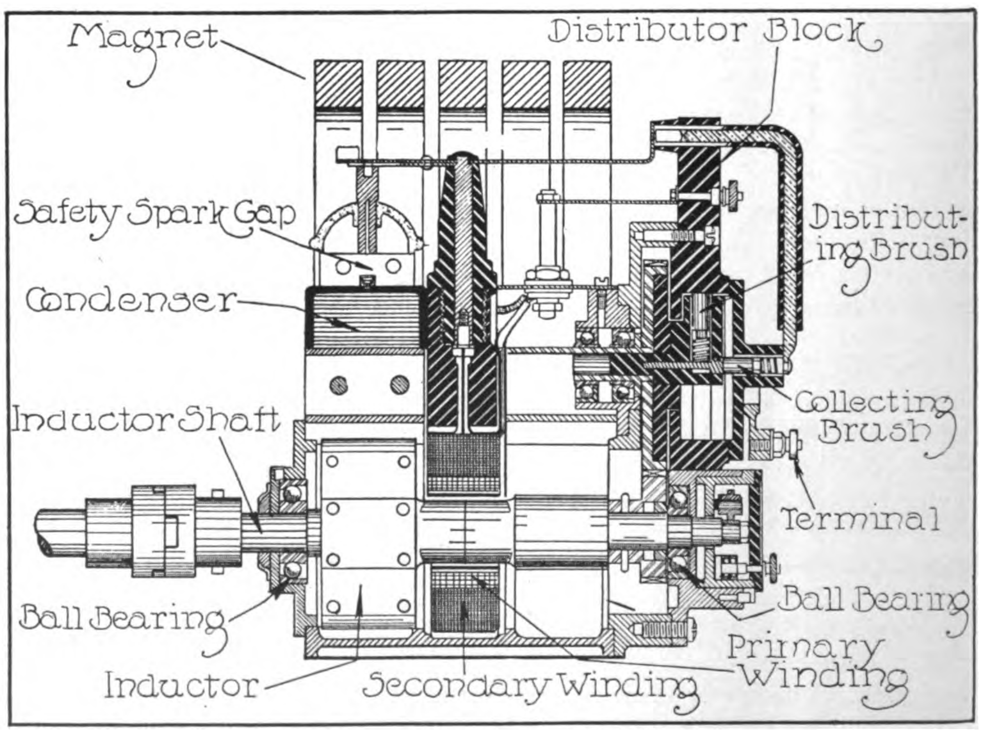


Fig. 70—Longitudinal Sectional Elevation of K-W Magneto, of the True-High Tension Type and Employing Stationary Windings.

at C is employed with four and six-cylinder units. Cam D is fitted to magnetos installed on eight-cylinder engines. All are driven at crankshaft speed, with the exception of the three and six-cylinder.

Cam B is employed with single-cylinder, two-cycle motors, C with two and three-cylinder units, and D with four, six and eight-cylinder engines. Drive is at crankshaft speed with the one, two and four-cylinder motors, 1.5 times with the three and six-cylinder units and twice the crankshaft speed with eight-cylinder engines. These cams are interchangeable.

This type of magneto is constructed to be positively driven in either direction, clockwise and anti-clockwise, the rotation being denoted by an arrow on the brass dust cap located on the driving end of the shaft.

(To Be Continued)

Ed. Note—The next installment will deal with other forms of low-tension magnetos, including those designated as high-tension.

TRUCK VS. MULE TEAM.

Some Interesting Comparative Figures Resulting from Week's Test in Quarry Work.

A recent test covering a week's operation of motor trucks and mule drawn wagons in the quarry service near Baltimore, Md., was conducted with interesting results. McMahon Bros. of Mt. Washington, Md., is using a five-ton and a four-ton Mack, made by the International Motor Company, New York City. These machines are fitted with automatic dumping bodies, and the Schwind Quarry Company is using them to haul broken stone for road building.

In order to show what could be done in this line a week's test was conducted with a five-ton Mack truck with automatic body in competition with a four-mule team wagon, hauling broken stone for road building from the quarry. The truck had to make 10 miles to a round trip to nine for the team, on account of having to go a mile out of the way on the trip from the quarry in order to avoid a bridge which was too weak to carry it loaded. One mile of the trip loaded was up a 14 per cent. grade.

The average amount of gasoline used was 21 gallons; oil, two gallons. The average number of working hours was 10; average time loading, three minutes; average time unloading, 10 minutes; total load carried, 60,000 pounds; number of trips, six; total mileage, 60. There were three rainy days during the test, so that the roads were soft and muddy.

Another advantage in the use of the truck was in the spreading of the stone. It took the truck 10 minutes to do this work, which the contractor stated was done better than could be done by hand, and the labor of two men working with shovels for one hour was saved. This spreading was regulated by opening the tailboard the proper distance and letting the truck travel slowly over the road with the body. The following figures represent in concrete form the results of the comparison:

Four-Mule Team Hauling 4.5 Tons a Day 27 Miles.

Four mules at $325 each	$1300.00	
Harness	75.00	
Wagon	250.00	
Total investment		$1625.00
Interest on one-half investment at 6 per cent.	$48.75	
Insurance on team	32.50	
Depreciation, 20 per cent	325.00	
Fixed charges a year		$406.25
Fixed charges a day		1.85

Assuming 225 Working Days a Year.

Wages a day	$1.84	
Feeding at 60 cents a head	2.40	
Stable man	.25	
Doctor	.20	
Shoeing	.30	
Repairs	.20	
*140 days' feeding at 40 cents a head, $224	.99	
Daily operating cost		$6.18
Fixed charges a day		1.85
Total daily operating cost		$8.03

Five-Ton Dump Truck, Hauling Five Tons a Day 60 Miles.

Truck		$5300.00
Interest on one-half investment at 6 per cent.	$159.00	
Insurance on truck, 2.5 per cent. on 80 per cent. of one-half value	53.00	
Depreciation on truck, not including tires	480.00	
Fixed charges a year		$692.00
Fixed charges a day		3.07

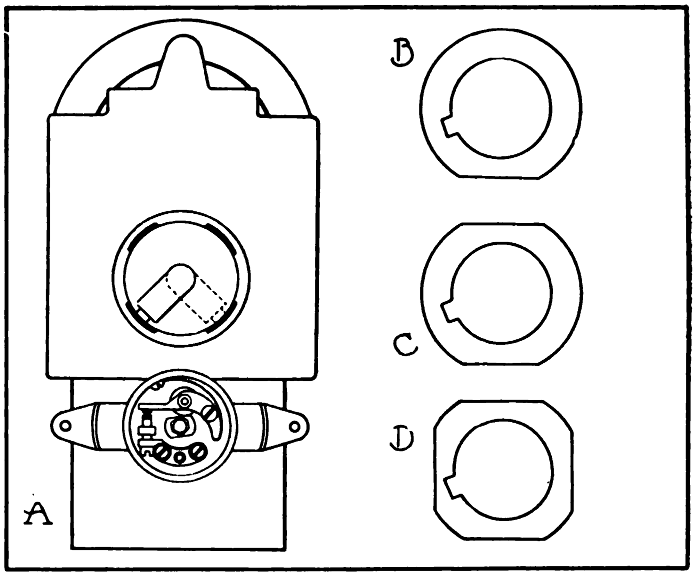


Fig. 71—Construction of Inductor Type of Magneto: A, Distributor and Circuit Breaker; B, C and D, Cams for One, Two and Four-Cylinder Instruments.

Assuming 225 Working Days a Year.

Wages a day	$2.50	
Maintenance, 4.5 cents a mile	2.70	
Tires, 6 cents a mile	3.60	
Gasoline, 4 cents a mile	2.40	
Oil	.60	
Daily operating cost		$11.80
Fixed charges a day		3.07
Total daily operating cost		$14.87

*Due to the mules not working, quarry being shut down, owing to weather conditions.

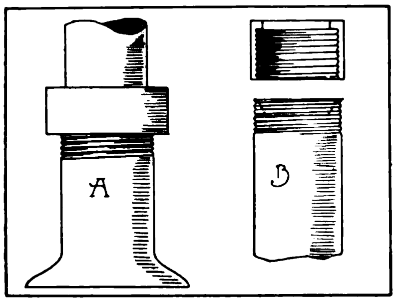
It was shown that a four-mule team hauls 13.5x4.25 at 57.37 ton-miles a day, 13.9 cents a ton-mile.

Five-ton truck hauls 5x30 at 150 ton-miles a day, 9.9 cents a ton-mile, or a saving of four cents a ton-mile, or $6 a day.

The dealers in Atlanta, Ga., have decided upon the week of Nov. 8-15 for their annual pleasure car and motor truck show, to be held in the Auditorium.

HINTS FOR PROPER MAINTENANCE.

EXHAUST pipes are constructed of steel tubing and are easily damaged. The fitting of a new tube requires care in the shaping, as it is an easy matter to kink the material, this not only resulting in an unsightly piece of work, but one that obstructs the flow of the gases. A method of bending is shown in an accompanying illustration, from which it will be seen that the pipe is passed through the hole in the block, while the copper loop forms the fulcrum for the lever. The leverage obtained enables short bends to be made without kinking, and it is secured by gradually moving the block, so that the pressure is not exerted continually at any one particular point during the operation.



Stuffing Box for Leaky Tappet Guides.

Before commencing to bend the pipe, a wire templet of the shape required should be made. If the tube be of copper it should be filled with resin, run in while hot and allowed to cool. Three articles are needed, as will be noted by the drawing: First, a hard wood block with a hole slightly larger than the diameter of the pipe; second, a loop made from an old piece of copper pipe, and third, a stout pinch bar of convenient length.

In bending steel tubing the same process is utilized, but the pipe is filled with sand, and the block should be of metal. The pipe is heated at the point at which the bend is desired, and is cooled off slightly on the side which forms an inner radius of the circle, to prevent kinking. A small hole should be drilled in the pipe in any convenient position to allow for the expansion of the sand when heated. Otherwise the contents are likely to be blown out during the bending process. Before fitting the pipe to the part it should be tested and inspected for flaws.

TAPPET GUIDE STUFFING BOX.

It is not an uncommon occurrence, upon lifting the hood of an old pleasure car that has been converted into a commercial vehicle, to note that the power plant is covered with dirty lubricant. This is generally due to worn tappet guides, although sometimes the oil will work out around the end bearings of the crankshaft. To fit new tappets and guides involves some expense, and the trouble may be remedied, if the design of the motor will permit, by making stuffing boxes as shown in an accompanying illustration.

In this instance the valves and pushrods were displaced and a thread cut on the outside of the guides, as shown at B. The interior of the guide was countersunk, as indicated by the dotted lines. The stuffing box was constructed of a piece of heavy brass tubing, drilled to form a lip at the top to hold the packing, and threaded inside. By using one-strand graphited candle wicking, soaking it with oil in the stuffing box, and screwing it down properly, the loss of lubricant from the crankcase was prevented. The device could be improved by using a lock nut below the stuffing box, this depending, of course, upon the space between it and the crankcase. The same method could be applied to some types of worn valve stem guides where considerable auxiliary air is noted.

RENOVATING FELT WASHERS.

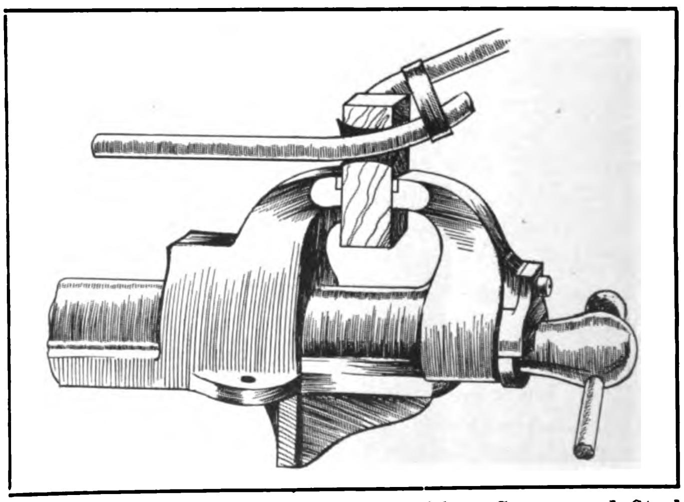
Felt washers that have become hardened or caked with old lubricant may be made serviceable by soaking them in gasoline or kerosene and flexing the material.

CARE OF THE COMMUTATOR.

Magnetos are generally fitted to commercial vehicles, but some machines are equipped with a low-tension magneto-generator having a timer and coil, such as the model T Ford for example. As the commutator is an important factor in the ignition system, breaking as it does the primary circuit, it should be cleaned and lubricated from time to time.

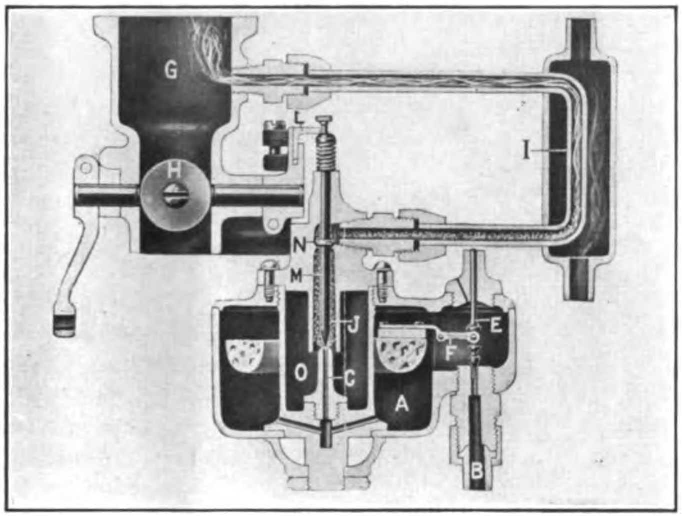
If it is accessible, it is a simple matter to remove the cover and wash out all dirt and old lubricant with gasoline, after which the working parts should be oiled, although some favor vaseline. If the timer cover cannot be displaced without considerable trouble, it may be washed by utilizing an oil can filled with gasoline and squirting the fuel through the lubrication opening.

If the car has seen considerable service it will be well to examine the timer bearings, fibre and contact blocks to note if they are worn. If the blocks are uneven the roller will have a tendency to jump, creating a poor contact, as well as affecting the operation of the motor. It is a simple matter to remove the fibre ring, take it to a machine shop and have it trued up.


Suggestion for Bending, Without Kinking, Copper and Steel Pipes of Large Diameter.

CHAMBRAY CARBURETOR UTILIZES HEAVY FUELS.

VAPORIZING and maintaining the vapor up to the time the mixture is ignited in the cylinder is one of the problems confronting designers of carbure-



Chambray Heavy Fuel Carburetor Utilizing Heat of Exhaust Pipe for Preventing Condensation of Mixture After Complete Vaporization.

tors and vaporizers utilizing heavy fuels. The Chambray Carburetor Company, Detroit, claims to have solved this problem in its Chambray carburetor, the most prominent feature of which is the conversion of the primary mixture, including the fuel and a small percentage of air, into a combustible gas before it is introduced into the intake pipe of the motor. It is also held that condensation or precipitation is eliminated, that the highly gaseous state is so fully maintained that it will burn when lighted as with any hydrocarbon gas.

Outwardly the design resembles the conventional carburetor, but its components differ, as will be noted by the accompanying sectional illustration. The fuel, whether it be kerosene or the heavier distillates of petroleum, enters at B, and the height of the fluid is regulated in the conventional manner by a needle valve. With the valve H closed, the primary air is drawn into the chamber O and passes up the tube J, carrying with it a jet of liquid from the nozzle C. The size of the orifice through which the fuel issues is regulated by the needle M, which in turn is actuated by the throttle H. Obviously, the amount of liquid may be augmented or decreased as best meets the requirements of the motor.

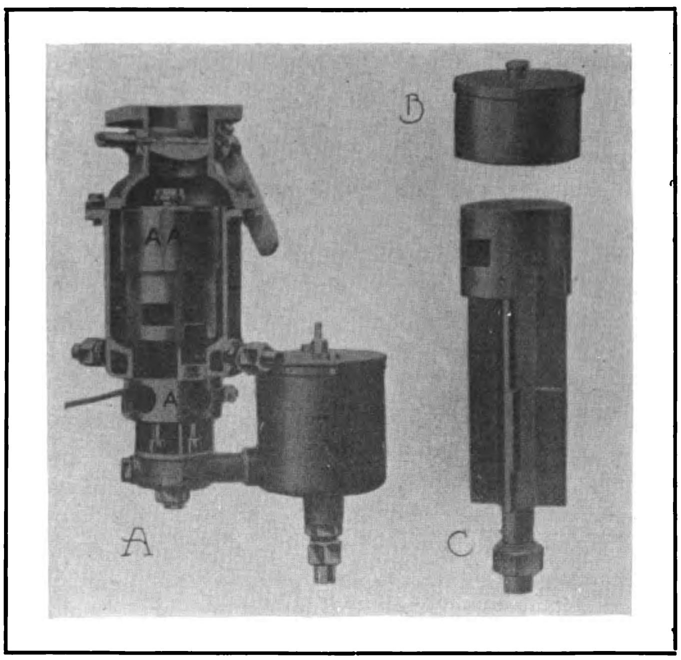
The primary air is controlled by the valve N, and it is stated that the construction maintains a high velocity. The resulting mixture, which passes through a copper tube I, located in the exhaust manifold, is thus heated and gasified. Although at first the mixture is held to be rich, through the action of the member L and resulting heat of the exhaust, it is stated to be productive of perfect combustion and to be independent of atmospheric changes. Three adjustments are incorporated, a low, intermediate and high.

The company is producing a priming device for the carburetor, whereby fuel is drawn direct from the supply tank through a .0625-inch copper tube. Along the course of this tube is an electrical heating device, current for which is supplied by a four or six-volt battery through a wire in the heating tract. It is stated that this construction will enable the starting of the motor cold on kerosene. A plunger valve is located in the priming attachment, which may be operated either from the seat or from the front of the machine, as best meets requirement.

SMITH FOUR-JET CARBURETOR.

A carburetor which has four jets and which is said to have been productive of motor efficiency as well as economy of fuel, is the Smith, the creation of S. Smith & Son, London, England. As will be noted by reference to the sectional view presented at A in an accompanying illustration, the design makes for simplicity and accessibility of components. It is stated that a new jet may be fitted in two minutes.

The first jet is of larger bore than the others and is used for starting, the second, third and fourth being brought into operation consecutively, and automatically. Centrally located in the main body of the device is the automatic controlling valve, which slides up and down, and as the surface is constantly washed by the moving mixture, it is kept free from foreign elements. It is stated that the float chamber may be fitted in eight different positions in relation to throttle valve. Not only is the mixture automatically controlled by the valve member A A, but the latter rises in propor-



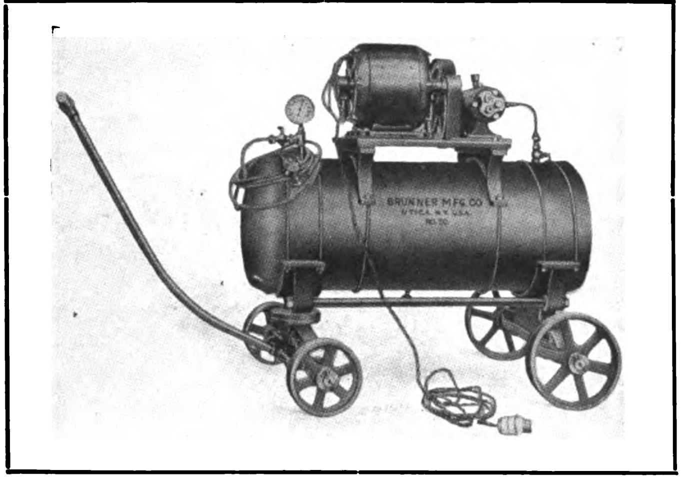
Smith Four-Jet Carburetor, Having an Automatic Controlling Valve: A, Sectional View; B and C, Choke Tube and Combination Piston and Sleeve Valve.

tion to the speed of the motor and uncovers the port of each succeeding choke tube, thus bringing the jets into action.

Each jet is calibrated and stamped with the number of cubic centimeters of fuel passing a minute, with suction equal to a six-inch head of gasoline, this condition being automatically maintained on each jet when in operation, irrespective of the speed of the engine. The adjustment is effected by changing the jets until the mixture is correct at all speeds. By means of a rotary sleeve valve operated by a lever, the driver can alter the mixture from the seat to suit varying atmospheric conditions. Connection to the water circulation system is made by six varying connections, a design making for easy installation.

GARAGE AND SERVICE STATION EQUIPMENT.

THE Brunner Manufacturing Company, Utica, N. Y., maker of the Parker and other forms of compressors, is producing what is termed the No. 50 portable outfit, which is high grade in every particular and designed to meet every requirement of service. It is a complete unit, as will be noted by an accompanying illustration, and is easily operated, a socket being fitted to a convenient circuit.



Brunner Portable Air Compressor Outfit, Utilising Electricity for Driving the Compressor.

The compressor has a capacity of one cubic foot of free air a minute, and the utilization of a safety valve permits of any desired pressure. The tank is of extra heavy steel, tested to 250 pounds, and is 30 inches long and 12 in diameter. Its capacity is 15 gallons (two cubic feet), and it is claimed that it will inflate two flat tires and harden up from eight to 12 according to their size. When the container is filled it will inflate one 36 by 4.5-inch casing to 90 pounds, also three ordinary sizes, before it is necessary to start the motor.

The motor is an electrical unit, .25 horsepower capacity, and is capable of starting the compressor against 120 pounds, and increasing it to 150. Either alternating or direct current motors are supplied, and of any voltage and cycle. The gears are held to be noiseless through the use of a rawhide pinion and a cut cast iron spur. The truck carrying the equipment is substantially constructed, the forward axle revolving on a king bolt, no casters being used. The forward wheels are cast iron, eight inches in diameter, the rear members 10. Patented cushion tired wheels are furnished at a slight extra cost. Each outfit includes 12 feet of .1875-inch rubber tubing, one stop cock, a 2.5-inch polished brass gauge, a globe valve controller between compressor and tank, electric cord and a tire connection. The finish is gloss black enamel. The fittings are polished brass and copper. The cost of operation is stated to be from one-quarter to two cents an hour.

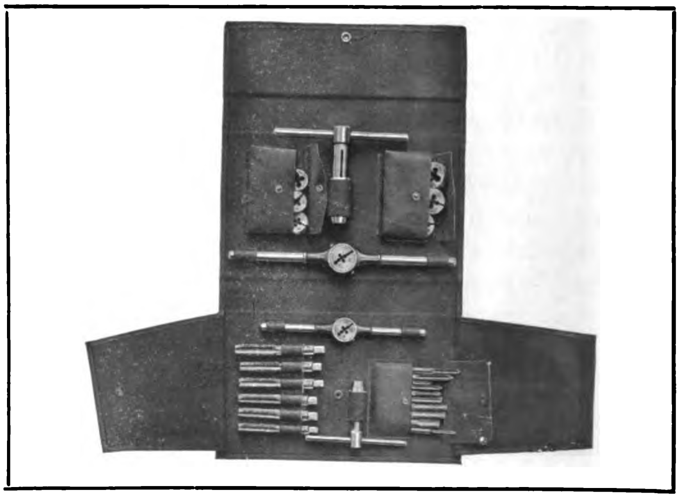
LIGHTNING REPAIR KIT.

The Wiley & Russell Manufacturing Company, Greenfield, Mass., maker of screw cutting tools, is marketing the Lightning auto repair kit shown in an accompanying illustration. The screw-cutting assortment is very complete and was designed with special reference to the screw threads found on the model T Ford and other medium priced cars. It comprises 16 taps, 16 dies, two stock and two tap wrenches, permitting of the cutting of threads from 18 to 32 an inch, also pipe threads; in fact, the equipment is adapted to a large variety of work and different makes of cars, etc.

The assortment comes in a genuine goat skin leather case, having compartments to protect the cutting edges of the tools, and the container is not only compact but very durable.

DETECTORPHONE.

An instrument for locating mysterious knocks or noises by an adaptation of the microphone principle is being produced by the Boston Talking Machine Company, 41 West street, Boston. The device comprises a receiver, similar to that employed by telephone operators, and the 'phone member. The latter is provided with a microphone button, changing the position of which is held to magnify the sound through the vibration travelling up the rod through the button, thence to the receiver and ear of the operator.



Wiley & Russell Lightning Auto Repair Kit, Containing Complete Assortment of Screw Cutting Taps, Dies, Etc.

CORRESPONDENCE WITH THE READER.

Generator Gives Trouble.

(43)—We are using a model T Ford for delivery purposes and frequently the car is employed to make night deliveries. Our driver complains that the carbide generator which came on the car gives trouble. We have fitted new burners and tubing but the trouble continues. We have also tried different sized carbide. Have been told that the generator is faulty. Any information will be duly appreciated. W. E. K.

Philadelphia, Penn., Aug. 21.

The trouble referred to is caused by more or less moisture in the gas generated, which condenses in the tubing leading to the burners. It is experienced with some types of generators, and with the design referred to can be cured by utilizing a condenser or trap in the piping between the generator and the lamps. It should be placed in the lowest point of the line, and will collect the moisture. These traps may be purchased or may be made at home.

At Fig. 1 is shown a condenser which may be constructed easily and which is inexpensive. The material required comprises a T coupling, a petcock and a piece of brass tubing. The latter is slipped over one end of the coupling and petcock as shown in the drawing and the joints soldered to make them gas tight. The petcock is necessary as it permits draining of the water. The device is clamped to the underside of the running board by strips of brass secured by screws. It is advisable to have the section of the coupling to which the petcock is secured at least an inch long to provide a suitable retaining capacity.

Lamps Burn Out.

(44)—Upon my suggestion my employer allowed me to fit electric headlights to our Ford delivery car. Since putting on the lamps I have experienced considerable trouble with the bulbs burning out. If I employ a bulb that won't burn out the light is poor at low speeds. On the other hand a bulb that gives me good light at low speeds burns out at high. What is the trouble and how may it be remedied? R. A. C.

Brockton, Mass., Aug. 23.

The voltage of the current generated by the flywheel magneto on the car mentioned varies with the speed of the motor, and the burning out of the filaments is due to too high a voltage. Similarly, when the motor is operating at low speed the current is not of sufficient value to heat the filament properly.

It is probable that the bulbs employed are not adapted for the work. There is a device upon the market which it is claimed will so regulate the current that a maximum light is obtained regardless of motor speeds. It is called the J & B light controller and is constructed especially for the model T Ford car.

Cleaning Radiator.

(45)—I have been experiencing trouble with the radiator of my car getting very warm. The water does not boil but it gets intensely hot. Have inspected the water pump and oiling system and both work perfectly. Carburetor has been giving no trouble and the mixture seems to be very good. A friend of mine advised the use of sal soda to clean the radiator. Kindly advise me if the use of sal soda would injure the radiator?

Pittsburg, Penn., Aug. 21. C. G. B.

The use of a solution of sal soda and water is recommended by makers of radiators and is not harmful. The heating of the radiator may be due to deposits caused by the continued use of the same water, which creates a scale which is due to minerals in the fluid.

The water should be drawn from the radiator and the cooler refilled with the soda preparation. Dissolve as much of sal soda in the water as possible, and use as much fluid as the system contains. It is a good plan to run the motor with the soda solution, the length of time depending on the condition of the radiator. If the old water was badly discolored, it may be advisable to operate the machine for an hour or more with the soda solution in the cooler.

After removing the solution replace with fresh water and continue to change it until all signs of discoloration are eliminated. Some make it a practise to insert the nozzle of a hose in the radiator filler member, running in fresh water with the motor operating. Of course the petcocks should be opened to allow the fluid to run out.

Proper Advance of Spark.

(46)—Will you give me some simple, concise advice on the advance of the spark lever? I have heard varying opinions. The motor in question is a four-cylinder, four-cycle and is used on a car of one ton capacity. W. S.

Lynn, Mass., Aug. 20.

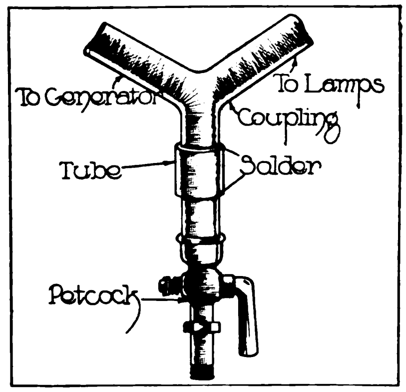


Fig. 1—Home Made Gas Condenser.

The spark lever should be advanced in proportion to the speed of the motor, and the amount of the lead is best determined by experience. Theoretically, the spark is supposed to occur when the piston has completed the compression stroke and to have begun the firing or impulse stroke. In practise, the time of the spark occurs earlier, so that the ignition of the mixture will be more or less complete upon the piston starting downward. At very low speeds, as in starting, the timing is so set that the spark takes place slightly after dead centre. As the speed of the piston is increased, the spark is made to occur earlier through movement of the breaker box or timer, which is actuated by the lever on the steering wheel. It is considered good practise to advance the spark in proportion to the speed of the motor and to retard it when the slightest knock is noted. There is a limit as to the advance; that is, beyond a certain point the efficiency of the engine is not improved.

The Gulf Refining Company, which owned 12 White trucks, has purchased 14 more that are to be delivered at different stations where they will be used for the haulage of oil products. The statement is made by the White Company that 18 of the leading oil companies have bought 145 White trucks.

New Commercial Car Accessories

Winsor Adjustable Valve Remover.

A valve lifter having interesting features, in that it may be adjusted to meet the requirements of varying motor design and is positive in its action, is the Winsor patented adjustable valve remover, made by the Winsor Manufacturing Company, 253 Eddy street, Providence, R. I. It differs from conventional designs in that the mechanism holding and preventing movement of the valve during the compression of the valve spring is screwed into the spark plug opening, a construction preventing slipping of the tool as well as providing a stable leverage. This spindle is screwed into the opening by the fingers until it seats against the valve head, and incorporated with the spindle is a barrel member which revolves. This permits of operation at any desired angle. The barrel is provided with a number of notches into which is hooked one end of a chain, and the free end of this is hooked to a lever. By depressing the lever, which is extra long, it is a simple matter to compress the valve spring and remove the locking mechanism. The spark plug valve cap is utilized for the exhaust members. Extra barrels are furnished to fit different threads at a slight cost. The Winsor is moderately priced and constructed of high grade material. It comes with a black enamel and a nickel finish.

Underwriter Automatic Valve.

Many disastrous fires, originating through a back fire of the carburetor, or ignition of the fumes of the fuel, could have been prevented had it been possible to shut off the fuel supply, confining the blaze to the contents of the carburetor. The Underwriter Valve Company, Industrial Trust Building, Providence, R. I., is marketing the Underwriter automatic valve, which is incorporated in the fuel line between the fuel supply and the carburetor, and which is so designed that the flow of gasoline is automatically shut off when the device is exposed to a certain temperature. This action is secured through the utilization of a link, which in fusing and separating actuates a spring which closes the valve proper. The link section of the valve is removable without disturbing the other parts, and the device is non-leakable. New links may be replaced easily, or a wire may be utilized to retain the valve in an open position until a new fuse can be fitted. The valve itself is constructed of bronze, copper and German silver, weighs but seven ounces and is very compact. The valve bodies are furnished in .125 and .25-inch pipe connections, although special sizes are constructed to order.

Dover Radiator Filler.

Many concerns are particular as to the appearance of their machines and maintain these in first class order, especially the trimmings. In renewing the supply of water in the radiator with an ordinary pail or hose, the polished surface is apt to be discolored unless care be exercised in the operation. The Dover Stamping & Manufacturing Company, Cambridge, Mass., is producing a handy article for this work in the form of a six-quart container having a hooded spout, which permits replenishing the supply of fluid without the usual spilling. The handle is serviceable, and the filler is constructed of heavy galvanized steel. A brass strainer is fitted, preventing the entrance of foreign elements into the cooler. The Dover radiator filler is moderately priced.

Apco Ford Anti-Rattlers.

The Auto Parts Company, Providence, R. I., maker of Ford specialties and accessories, is offering a new device known as the Apco Ford Anti-Rattler. It is made in two styles, one with a screw adjustment and the other with a disc. They are utilized to eliminate the rattle caused by wear of the front axle radius rod ball bearing, which is constructed without means for adjustment. The screw design makes for great convenience in that fine adjustments may be made, the operation involving the removal of a cotter pin and rotating the screw plug until a slot in it registers with the housing member. The other type employs a number of thin discs. A coil spring provides for a cushioning effect, eliminating vibration as well as undue wear, and presses a hardened cup shaped cone against the ball proper. Both types are moderately priced and guaranteed.

Dalitz Spark Plug Tester.

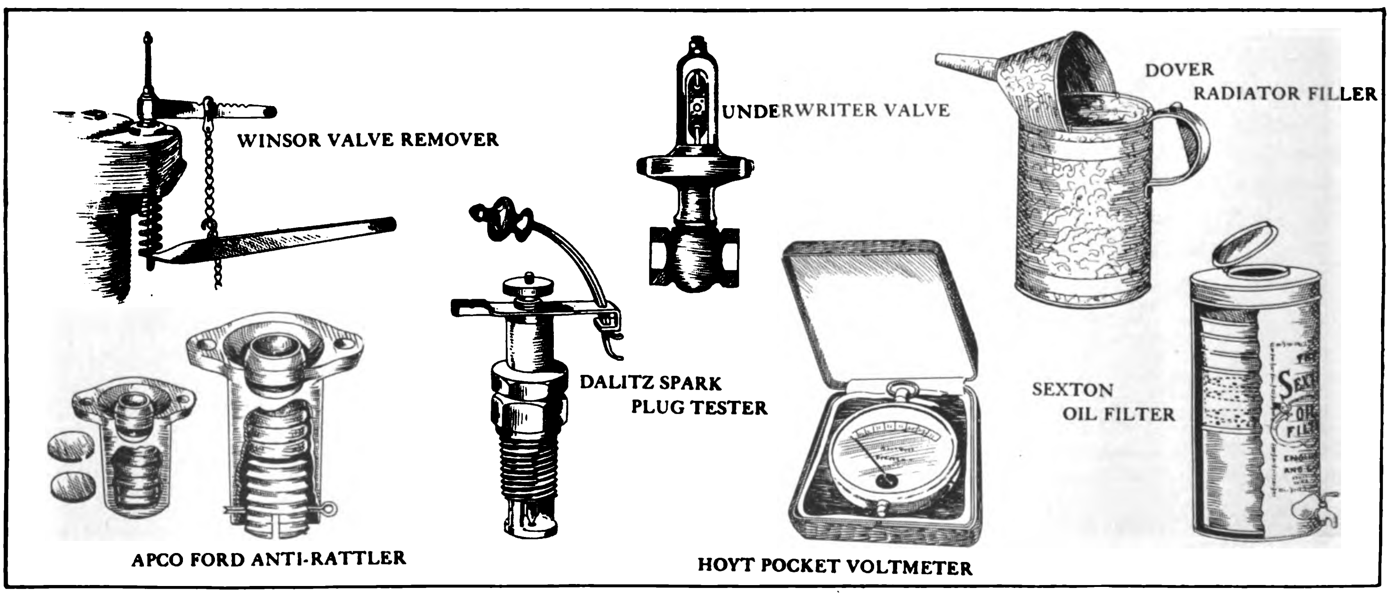
The Dalitz Manufacturing & Sales Company, 803 Union street, Seattle, Wash., is introducing the Dalitz spark plug tester and terminal, which is a simple and easily attached device for testing faulty ignition, locating knocks, and for preventing operation of the car by others than those intended. It is secured to the spark plug, being retained by the regular terminal nut, and provision is made for attaching the secondary wire. The device includes a movable metal part with an insulated handle, and normally there is no contact between the metal and the ground or base of the plug. By sliding the movable part, the current is grounded, thereby cutting out the cylinder. The tester may also be utilized to note the strength of the spark by making a gap, and the ignition system may be locked by grounding, as above described.

Sexton Oil Filter.

In changing the lubricant in the crankcase of a motor, the old oil is generally thrown away. The Sexton Can Company, 2 Hartford street, Boston, is manufacturing the Sexton oil filter, which is a sturdily constructed vessel 10 inches in diameter and 20 high, although different sizes are made to meet individual requirements. The can is provided with a hinged top and a series of filtering members, also a faucet for removing the filtered oil.

Hoyt Pocket Voltmeter.

The storage battery utilized for ignition or lighting, requires proper care and the cells should be tested from time to time to note their condition. The Hoyt Electrical Instrument Works, Penacook, N. H., maker of current indicating devices, is marketing a voltmeter of the pocket type, which is guaranteed to be accurate. The new meter, which is of the coil type, comes in a sturdy case, averages about 40 ohms a volt, is dead beat in action, slightly larger than a watch, and is moderately priced. Being designed especially for storage batteries, it forms a valuable addition to the car or garage equipment.



Illustrating Some of the More Recent Accessories Adaptable to the Commercial Vehicle, Public Service Station, Etc.

GASOLINE LOCOMOTIVES ECONOMICAL.

Large Saving Made by Waltham Trap Rock Company in Handling 500 Tons of Stone Daily on Industrial Railroad in Its Quarry, by Change from Manual Work.

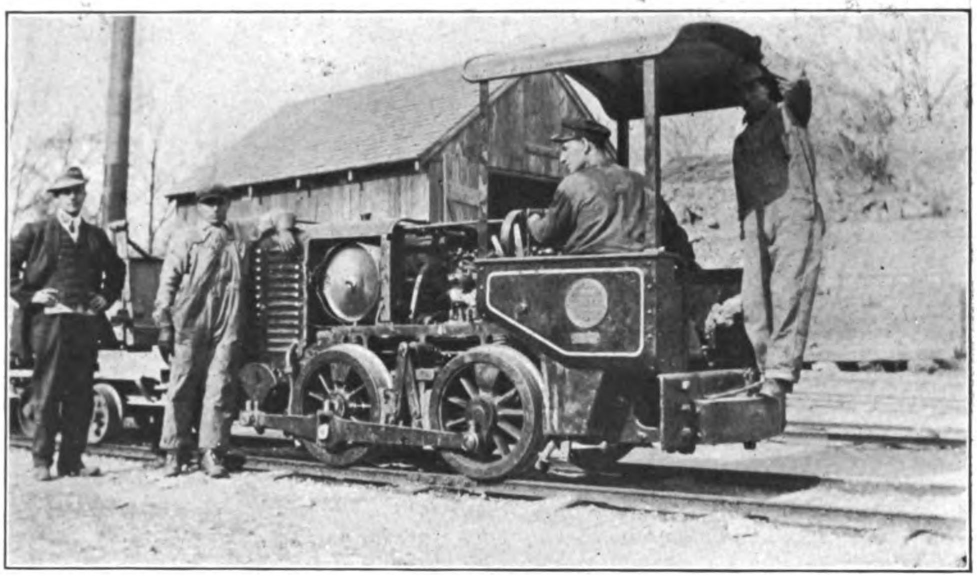
AT THE quarry of the Waltham Trap Rock Company, near the Stony Brook station, Weston, Mass., an industrial railroad is in operation such as is used by many large contractors when the operations are of considerable proportions. This installation is interesting from the fact that a gasoline locomotive is used instead of the usual steam locomotive or cables operated from stationary engines, or horses. As this company has an output of 500 tons of crushed stone daily, and it is intended to increase this to 600 tons a day, it will be understood that the haulage is a matter of great importance, and an economy of a fraction of a cent a ton would amount to a considerable sum in the course of a year. The company operates about nine months of the year, stopping work during January, February and March as a rule.

Industrial railroads vary in size of ties, rails, rolling stock, etc., and the cars will contain from one to three cubic yards of sand or stone. These installations are found very serviceable for excavating and filling, as the track can be laid on almost any reasonably level surfacing and can be quickly removed or changed. Generally the rails and ties are assembled in sections so they may be conveniently handled, and these sections are bolted together, the switches and the cross-overs being similarly constructed.

Frequently large contractors have tracks, cars and locomotive included with their regular equipment, and whenever a job warrants the railroad complete is shipped with the usual paraphernalia. The steam locomotive or the engine used for cable haulage requires fuel and water in considerable quantities, and in many instances the engineers must be licensed, while there are other requirements, such as boiler inspections and the line, to say nothing of the items of expense, including insurance, that may be incurred. When power is not used the track may be laid with sufficient grade so that the loaded cars may be run by gravity from the point of loading to that of unloading, and then they are hauled back by animals or are pushed by men. Where the job is large railroads have been operated in buildings, and under such circumstances manual power is always used.

The Waltham Trap Rock Company has a quarry to which a spur track extends from the Boston & Maine tracks, and beside the track is the crusher. The crusher is located on the steep side of a hill, and about 15 feet above the railroad is the boiler house, and the base of the conveyor that takes the broken rock to the crusher. From this point the quarry extends into the hill like a great fan, the excavation being at the rear close to 100 feet below the surface of the ground. From the crusher to the furthest point into the trap rock ledge is nearly 700 feet, and the bottom of the quarry is worked as close to a level as is practicable.

When the men burrowed into the hillside for a time handling the rock was a matter of ease, but as the work progressed a railroad was believed to be the only solution, and the equipment was purchased. The cost of a locomotive was large, and with the necessary expenses and limitations in connection with its use the management decided to have the men push the cars. This was not expensive so long as the distance was short, but when the trackage had increased to about 1000 feet, and it was 600 feet from the broken rock to the crusher, 10 or 12 men were necessary to push the cars, although the track was laid to have a slight grade. While the men could work a part of the time on loading, they were kept busy most of the time with the cars, and last year the company decided to purchase a locomotive.



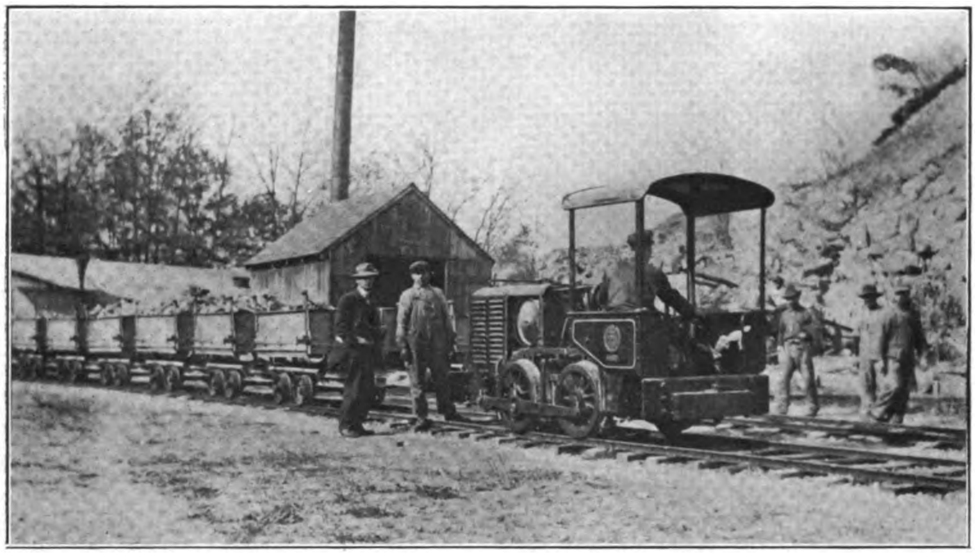
Baldwin Gasoline Locomotive, 40 Horsepower, That Hauls 500 Tons of Broken Stone Daily in Nine Hours at the Quarry of the Waltham Trap Rock Company.

The machine decided on was built by the Baldwin Locomotive Works, Philadelphia, and it is designed for industrial railroad work. The motive power is furnshed by a four-cylnder, water-cooled gasoline motor, with a cylinder bore of 4.25 inches and stroke of 5.5 inches, developing 40 horsepower at 1000 revolutions a minute. This engine is installed longitudinally

in the chassis, and its position is reversed with reference to the customary motor vehicle installation, the flywheel being forward and the starting crank located in the centre of the cab. When first received a dry plate clutch was used, but this was not satisfactory, and it was replaced by a Hele-Shaw multiple disc clutch, such as are usually used in motor vehicles.

The locomotive is driven by four wheels with connecting rods coupled to a cross shaft that is driven by bevel gears, with clutches that afford high or low speed and reverse, the cross shaft carrying counter weights, so that there is no dead centre. In mechanical phraseology, the drive is through patented Scotch yokes. The gear reduction is large and the locomotive is supposedly limited to 10 miles an hour on the high speed, but it can be driven at nearly double that speed.

In the work that is done in the quarry the locomotive is driven 10 hours a day and over the track that is laid out like the ribs of a gigantic leaf, there being a main line with three branches, each of which has three branches and two of these two more, so that cars can be drawn to the end of the lines and loaded with the broken stone. The rock is blasted and sometimes thousands of tons of stone are loosened, and the pieces are sometimes blasted or broken with hammers. The cars are loaded by hand and are hauled to the other end, where they are dumped at the crusher and then backed out on a siding. The company has about 20 cars, and these are kept in motion as much as is possible, some days there being as high as 250 loads drawn. The machine will haul 15 loaded cars, and frequently from three to a half-dozen are drawn at a time.



Gasoline Locomotive and Train of Steel Cars of Two Tons Capacity, Used on Industrial Railroad of the Waltham Trap Rock Company.

The locomotive is operated by an engineer, who has a state automobile driver's license, not from necessity, but because he has had a thorough training as an automobile mechanic, and he is using a motor such as might be used in a five-ton truck. The machine is operated by levers that control the speeds and a wheel that varies the carburetor mixture. One of the chief difficulties experienced with it was in adjusting the carburetor to secure a sufficient supply of fuel so that the motor could be operated slowly, and since this was accomplished the locomotive has been driven with every degree of satisfaction. The speed of the locomotive is slow at all times and naturally the desire is to obtain power at comparatively low engine speed.

The cost of operation is small, for as a rule between three and four gallons of gasoline will suffice for the haulage of from 200 to 250 cars and from 400 to 500 tons of stone, and about a quart of oil will meet all lubricating requirements. The radiating system is large, and the engine has never been heated above a normal temperature, but while the fan draws the air through the two radiators the hood is often lifted to allow free circulation about the motor. The locomotive weighs about 3.5 tons and is extremely solidly built, and it is surprisingly easy riding. Occasionally it leaves the rails, but it climbs back on to the metal again like a cat. It is kept in a small house in which is a pit, so that men may work under it if necessary. When the work for the year is completed the machine is well oiled and greased and stored in this building until the time for resumption of work.

The track is laid wherever cars are wanted, and by disconnecting the sections it can be taken up and relaid without difficulty, this work being often necessary when blasting is done. During the winter season the track is left in the quarry and in the spring a little blocking and oiling the switches will place it in good condition.

As to the economy of the locomotive, this cannot be shown in dollars and cents, for the company has kept no record that would specify it, but to do the work by hand would require at least 10 or 12 additional men than are now employed, and these would be paid the prevailing day wage. Undoubtedly these men might be used to some advantage, but the manager of the company says without hesitancy that the locomotive paid for itself in a year, and this statement was made without qualification. The engineer has a man with him who couples the cars, throws the switches and does other work of this character, so it may be said that two men are required to man it, but against the wages of these can be placed the pay of the men who would be used were the cars hauled manually. As the greater experience is had with the locomotive, the better work is accomplished, and as there is but little wear because of the slow speed, the heavy construction and the comparatively smooth track, the management believes that it will be serviceable for many years and be equally productive and is satisfied that it is an economical proposition.

The MOTOR TRUCK

Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., OCTOBER, 1913 No. 10

IDEAL CENTRAL STATION SERVICE DEPOT.

New Plant of the Edison Electric Illuminating Company of Boston, Developed to Serve a Territory of 600 Square Miles, and Splendidly Planned, Includes the Best Garaging and Transportation Facilities in America.

By William W. Scott.

WHAT is without question the largest and most carefully developed central station garage in America, if not in the world, is that just completed and occupied by the Edison Electric Illuminating Company of Boston, located on a tract of approximately 12 acres of land in Massachusetts avenue

The Electric Garage of the Boston Edison Company, 236 Feet Length and 110 Feet Width, with Accommodation for 110 Machines, the Finest Service Station in America.

in that city. The statement made applies to the plant as it now exists, but as it has not as yet been completed, and as work on it will continue for a considerable length of time, this article will deal very largely with the garage and the transportation department, and will not discuss the general proposition of a central service station save outlining the plan as a whole, and defining the relation of the transportation department and the station.

The Edison Electric Illuminating Company of Boston was originally organized to afford a general distribution of electric current at Boston, but when the enterprise became well established and the possibilities were realized expansion was conceived. This resulted in the acquisition of different lighting companies in the adjacent cities and towns, the taking over of the plants, and the consolidation of these services, until today the company is one of the largest in America. Boston

stretches southwest from tidewater for a distance of approximately 11 miles. On the north side of the Charles river and across the harbor are Charlestown and East Boston, and including these the greatest length of the city is slightly in excess of 13 miles. The width from the Quincy line to Watertown is not far from nine miles, but the town of Brookline is sandwiched in between the city and Allston and Brighton, so that this distance is more than the width of the municipality.

The Edison Territory.

Radiating in fan-shape from the water front in Boston is what is now generally known as Edison territory, and this includes an area of about 600 square miles, having a population of nearly 2,000,000 persons. Outside of Boston, and the suburbs of Allston and Brighton, the service of the company reaches the cities of Chelsea, Newton, Somerville, Waltham and Woburn, and the towns of Arlington, Ashland, Bedford, Bellingham, Brookline, Burlington, Canton, Carlisle, Dedham, Dover, Framingham, Holliston, Hopkinton, Lexington, Lincoln, Medfield, Medway, Millis, Milton, Natick, Needham, Norfolk, Norwood, Sharon, Sherborn, Stoneham, Sudbury, Walpole, Watertown, Wayland, Weston, Westwood and Winchester, and within this area, as will be noted from the map that is shown, is the city of Cambridge and the town of Belmont. There is a separate lighting company in Cambridge that gives a service to the town of Belmont.

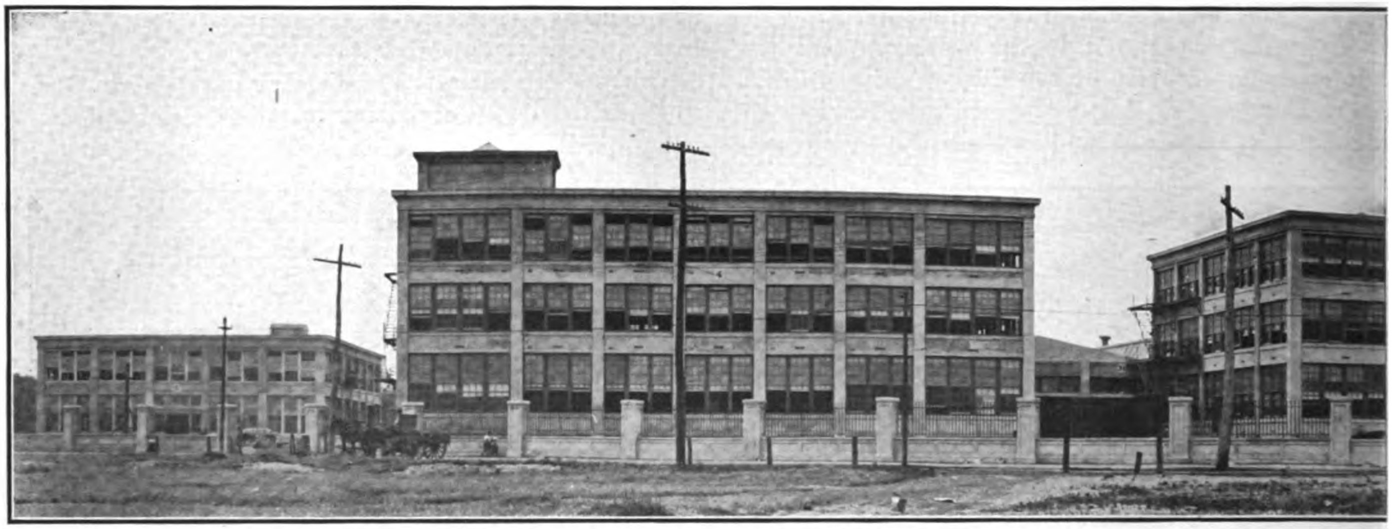
A glance at the map will show the area, as it is indicated by the shaded portions, each town and city being outlined. The suburbs of Boston, Dorchester, Roxbury, Hyde Park, Allston and Brighton are defined within that municipality. Regarding Boston as the centre it will be noted that the Edison territory extends northwest, west and southwest inland, but does not follow the coast save at the water fronts of Boston, Somerville and Chelsea. As a matter of fact the eastern line of the section is nearly north and south, and the extreme western line, which is that of the town of Hopkinton, is more than 30 miles from the centre of Boston. The extreme southern points are those of Sharon and Bellingham, and the southern boundary of the latter is the Rhode Island state line. While a considerable part is north of Boston, the distance to the northern line of Carlisle is by no means as far as Bellingham. The greatest distance between points within the area is about 40 miles, or, to put it more clearly, between the central service station and the extreme point reached by the lighting or power lines.

The Company's Investment.

Within the Edison territory, so-called, the company has property that is valued at more than $30,000,000, this consisting of office buildings, power plants, shops of different kinds, storehouses, pole yards and the thousands of miles of cable and feed wire construction, both underground and overhead, as well as the great diversity of equipment necessary for the maintenance of the systems of distributing the current. This property is maintained at the highest standard.

When the company acquired the different plants and consolidated them it was necessary to follow a policy that was dependent upon circumstances, for centralization was not always economical, that is, to the extent of abandoning property or discontinuing its use, and, of course, the standardizing of equipment or construction could not be hastily decided. But the ultimate purpose was the creation of a system that would afford a constant and certain service, that would be protected so far as possible against such influences as might cause interruption or destruction, that could be expanded with economy, that would require a minimum of upkeep expense, and would be profitable to operate. As might be assumed, the development problem is very large, and this applies to every phase, not only to the distributing system, but to property of every character.

The policy of the company has been to develop substantially, and its property in appearance is such as to always establish the prestige and to impress the observer with the strength and stability of so great and important an industry. The attitude of the company



The Service Depot of the Edison Electric Illuminating Company of Boston, Located on a Tract of 12 Acres in Massachusetts atory, Gasoline and Electric Machine Garage, Covered Drive or Loading Space,

to the public has always been to command respect and commendation, and the welfare of its employees has been given characteristic consideration.

The Administration Plan.

The Edison territory is divided for the purpose of administration purposes, so far as maintenance and construction are concerned, into seven different districts, which are shown on the accompanying map by different shading. One of these consists of the cities of Chelsea, Somerville and Woburn, and the towns of Arlington, Bedford, Burlington, Carlisle, Lexington, Stoneham and Winchester; the second consists of Ashland, Dover (one-half), Framingham, Holliston, Hopkinton, Natick and Sherborn; the third includes Lincoln, Sudbury, Wayland, Waltham and Weston; the fourth is composed of Boston (except Allston and Brighton), Canton, Dedham, Dover (one-half), Milton and Westwood; the fifth includes Bellingham, Medfield, Medway, Millis, Norfolk, Norwood, Sharon and Walpole; the sixth is made up of Needham and Newton, and the seventh of Brookline, Boston (Allston and Brighton) and Watertown.

For operating purposes the districts have separate organizations, each in charge of a foreman, and in each district pole yards are located at convenient places. In connection with construction, work is carried on by another organization, installation being made by the construction departments and up to a definite amount of work by the maintenance department, so that there are three separate divisions that carry on the extension and development, each in harmony with the others, and so systematized that while each has a separate existence the work is never in conflict and expedition and results are always certain.

Demands of the Service.

The company's service is of every character. This means street, building and residential lighting, current distribution for power, heating, cooking, manufacturing, battery charging and any other purpose required. The demand is constant and yet variable. Wherever a customer desires service this is, as a rule, supplied, and it is as necessary to maintain this at the same maximum efficiency at the greatest distance as at the nearest. This can only be done through unceasing supervision and with ample provision to meet any emergency that may arise, for interruption may mean danger to life and property, loss of business by the customer, and dissatisfaction generally, to say nothing of the diminished revenue to the company, as well as the expense for restoration.

Considering the conditions for a moment it will be understood that expansion or development work may be carried on with a view of completion at a specified time, the work of the contract department is with the purpose of affording service at a definite date, and the maintenance department is required to make such renewals and repairs as may be necessary to maintain the service at its normal efficiency. But in addition to this the construction and the maintenance departments must deal with all emergencies and restore the service in the quickest time that is possible.

Avenue, an Ideal Situation for Distribution Over 600 Square Miles of Territory—From Left to Right the Buildings Are: Labor- Temporary Administration Building and Stock House, Storehouse and Power Plant.

In the event of storm, which may damage or impair the overhead construction, cause the flooding of the conduits, the breaking of cables or wires, fires or other happening, it is necessary that the company and its patrons be protected so far as possible, and this means that besides the usual work there must be provision made to instantly begin a temporary or, if possible, a permanent repair or reconstruction of practically any proportion. As approximately 600 square miles of territory must be served with workers and material of any character, it will be realized that there must be means of quick and efficient transportation and of organization for systematically reaching any given point with the least loss of time.

The Transportation Department.

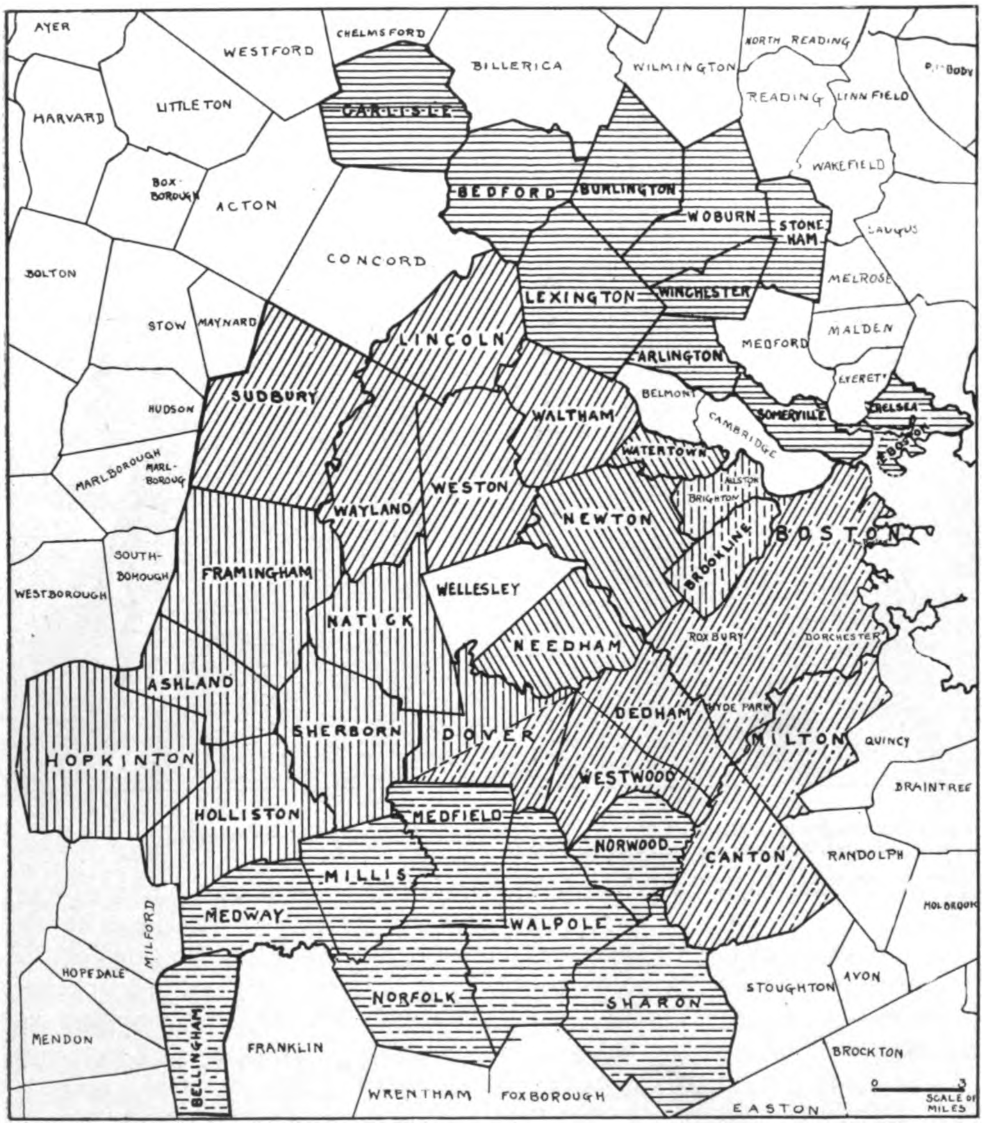
The transportation department is expected to have facilities for every requirement. It is to minimize expense so far as this can be done in the regular or routine work, but when emergency demands the cost is a

secondary consideration. The first result to be obtained is to restore the service. When this has been accomplished economy becomes a normal factor. This necessitates the maintenance of equipment that might not be utilized to its capacity, but a small part of the time, and it is desirable to minimize expense during the period it is not actually in use.

In the transportation work of the company, when it was principally doing business in Boston, horse vehicles were used. Later on freight and express service became necessary, and in emergencies haulage was done direct from the storehouse and shops of the company in Boston. As stated, pole yards were located in different places in the districts and at small stock houses were kept such material as might be required in regular construction and maintenance. This necessitated district organizations for transportation facilities, all under the supervision of the head of the transportation department and yet directly under control of the men in charge of the work in the districts.

The policy of the company was toward centralization, so far as this could be accomplished. With horses it was necessary to have the haulage equipment located where it could be used to the best advantage, for it was impossible to make long hauls save under conditions of great need, and time was a vital factor. In Boston the horses were kept at different stables, and in the towns and cities where equipment was permanently located this was stationed as conveniently as possible to the centres of activities. As the company's territory increased the needs multiplied and the facilities were brought up to the requirements, but creating a condition that was keenly realized.

The company purchased its first motor vehicle in 1903, and with the increased use of this form of equipment and the greater knowledge of the conditions with which the company had to deal, a careful study was made of the transportation problem that, with the definite result of observations, developed a plan that is now in part realized. The magnitude of the proposition may be understood when it is known that nearly three years' time was necessary to construct the plan, and more than a year has been required to execute it to a point where its benefits are obtained. But while a considerable period must elapse before the plant as it is planned will be complete, there is every probability that it will be in a state of transition for many years, for it will be expanded as the needs of the service are manifested.



Map of the Towns and Cities Served by the Edison Electric Illuminating Company of Boston, the Shading Showing the Area of the Territory, and the Difference in Shading Lines the Seven Districts Into Which It Is Divided for Administration Purposes.

The executives of the company approved a plan, and then began the constructive work. Briefly, this plan comprehends the following: A service depot which includes a power house, store house, stock house and shops, garage and a laboratory, together with such other buildings as may be necessary from time to time, as well as a structure given over to the welfare of the employees and such provision as may be desirable for their comfort and convenience. In connection with this is to be maintained sub-service depots for the construction and maintenance of lines departments, and in the further removed sections subservice stations for all the service departments.

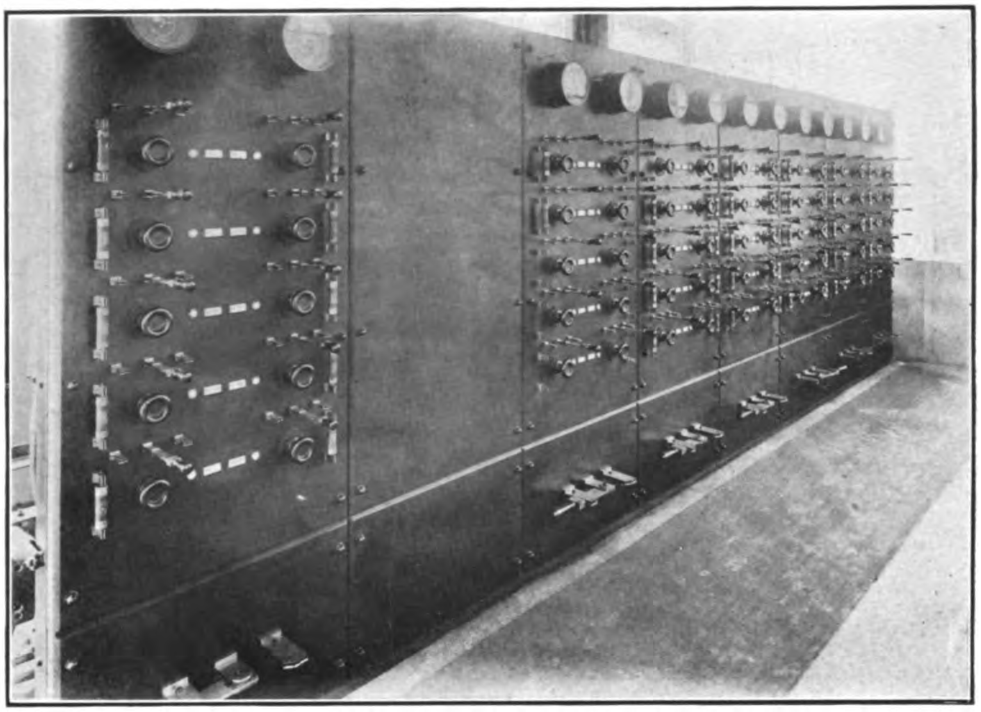
Massachusetts Avenue Plant.

The company purchased a tract of approximately 12 acres between the tracks of the New Haven railroad

and Massachusetts avenue, in the extreme east side of the Roxbury section of the city, close to what is known as South Bay. On this was begun the erection of a series of buildings of reinforced concrete. These are in order, from south to north (and as seen in the illustration from right to left), the power house, the storehouse for heavy materials, general offices, the shops and the stock room; in the rear, the covered driveway and loading platform, the gasoline and electric garage and the laboratory. The property is roughly triangular in shape, and the buildings are located in the apex, close to the New Haven railroad. The structures as built, aside from the laboratory, are in line with reference to the frontage, and stand at an angle from Massachusetts avenue when viewed from that highway. Between the buildings and the street, however, is a considerable area, and this will, if demands justify, be available for the expansion of the plant. The original plans had this provision for possible increase, which will indicate to what extent the future has been anticipated.

These five buildings are the beginning of a group that may eventually cover the entire property, or so much of it as can be built on. In addition to these there is to be constructed within a comparatively short time welfare buildings, which will be removed somewhat from the others for obvious reasons. This article deals with the plant but incidentally aside from the provision made for the transportation department, and the shops, storehouses, power house and the laboratory will be passed over with briefest description. From the viewpoint of the central stations these buildings, however, are exceedingly important, and if space would permit would be worthy of detailed attention.

The advantages of the centralized depot are manifold. It is located on the direct line of the New Haven railroad, from which spur tracks extend to sidings, where cars may be received or sent out and a small train of cars can be cared for on the siding and in the yard, making the receiving and shipping by freight almost ideal. The depot is but a short distance from the freight yard and cars may be sent out or brought in quickly in the event of car shipments. The depot is convenient of access from all parts of Boston and vicinity for haulage, being accessible by Massachusetts avenue from the southern, western and northern sections, and by Albany street from the business section of the city. Between the railroad and the buildings is a large reservoir, that is for fire protection in the event of damage or destruction of the usual service water mains of the city, and a large pump will afford ample pressure for a special yard water supply, which can also be used to supplement the city service. The buildings are sufficiently isolated so that there is little probability of a fire in that part of the city ever reaching them, and the construction is fireproof so far as science has proven is practical. Back of the buildings is a large area that may be used for railroad tracks and open air storage, and incidentally provision will be made for recreation grounds for the employees. There is a very good trolley service, so that the plant can be reached readily by the workers. All of these factors were carefully considered in the plan, and there was a distinct purpose in practically every detail decided on. It is also desirable to mention that practically all of the buildings can be materially increased in proportions by the building of additional stories on to them.

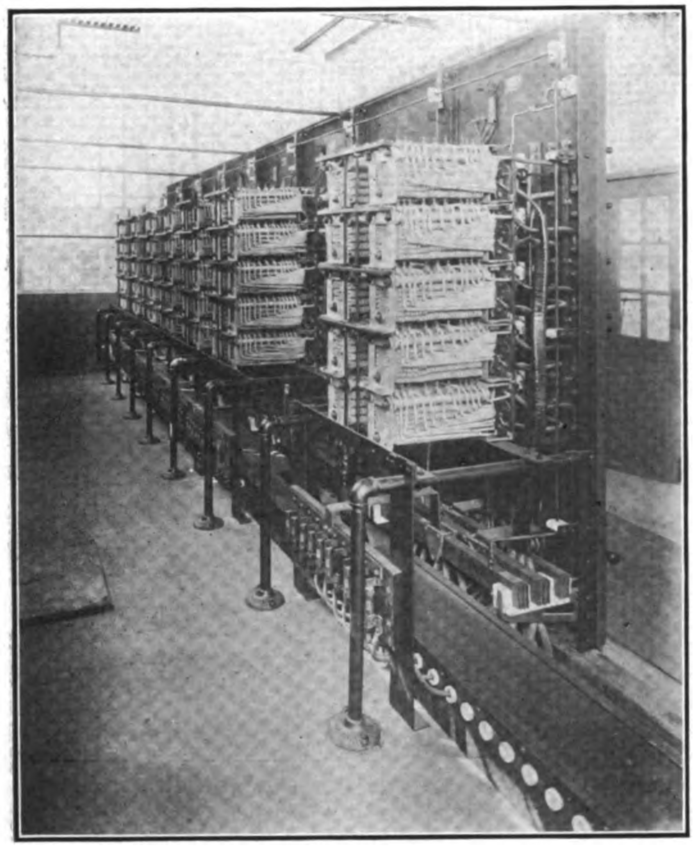


The Switchboard in the Battery Room of the Electric Garage, Showing the Variable Voltage Switches Near the Bases of the Panels, and the Numbered Indications of the Circuits and the Vehicles Charged on Them.

Considering the buildings separately. At the extreme right from the front of the plant is the power house. This is provided with boilers for heating and with three motor generators sets, two of 200 kilowatt and one of 50 kilowatt capacity, and these may be used independently or collectively, affording both power and heating. The equipment is the best that can be procured and the installation is made with the purpose of securing the greatest economy and service. At the extreme left of the present buildings is the laboratory. This structure is now approaching completion and it will have the finest of equipment for testing and developing electrical apparatus. A finely fitted photographic studio is located in the second floor, as well as a photometer room designed for light testing. The laboratory is a department of prime importance and

everything essential or desirable will be provided.

Between the power house and the laboratory are located, from right to left, the storehouse, the stock house and shops, and the garage, the latter being a combination building for both electric and gasoline machines. The storehouse is a single-story building, in which is the shop of the maintenance department, this being fitted with such machine tools as are necessary for alterations, changes and repairs, and equipment for testing machines of different kinds kept in stock and utilized for regular installations. Here, also, are kept the heavy cable and wire, the material of different kinds required in construction and maintenance work, with floor cranes and electric trolley cranes for handling heavy units. This division is departmentalized and the divisions are by heavy gratings. The building is protected from fire by a sprinkler system and it is well heated and lighted. Between this building and the stockroom is a drive with numerous doors so that each department can be reached conveniently from it.



Back of the Switchboard, Showing Its Accessibility, the Double Set of Bus Bars, the Terminal Conduit and the Quickly Removable Resistance Units.

The third building as it appears in the illustration is of three stories, and this is used for the present for administration and general office purposes, but later on this will be devoted to other uses, in part at least. The three-story portion of the structure is 110 feet frontage and 80 feet depth, and back of this is a single-story building, with basement, 110 feet width and 236 feet length. Entering this from the front, at the right are the shops, where the lamps, meters and general equipment are examined and tested before being used or previous to placing in stock, and at the left are the stockrooms, in which in bins and compartments are kept all lamps, meters and material of all kinds used in light construction and installations. In the basement stock is stored and from this the supplies in the different rooms are replenished. At the rear end of this building is a stall that will hold the largest freight car. Into this stall extends a spur track. A lift bridge affords passage across the stall when it is not in use. The floor of the building is level with the floor of a car on the track. A car can be unloaded under shelter and the contents sent to the basement by chutes. In the stall a car can be quickly loaded or unloaded and with no possibility of the contents being damaged by storm or handling. This stall serves as a garage for an electric locomotive used to handle the freight cars in the yard or on the siding, and there is a charging outlet and plug by which the locomotive battery may be charged at night or given a boost by day if this be needed. With this locomotive the company can handle its cars independently of the railroad, and the combination stall simplifies the problem of sheltering the equipment and handling the freight.

The Garage Facilities.

The building at the left of the stock house is the garage, which is in two sections, the three-story part seen in the illustration, and a single-story construction behind it. The picture shows a continuity of structure between the two three-story sections, and this is the end of the roofing over the drive between the buildings. While this is a drive in the use made of it, it is also a loading shed, and with comparatively little change it could be made to serve for additional garaging purposes. The two buildings are 70 feet apart, and over this space, 236 feet long, stretches a modified monitor roof, supported by trussed girders, without a post or obstruction, with end walls in which are three entrances. These entrances can be closed by doors and the entire loading shed kept at a reasonable working temperature in the coldest weather.

The full length of the stock house side of the drive is a loading platform at the floor level, and at the height of the wagon or truck body floor, that is 10 feet in width. The drive itself is paved with brick paving at such inclination as will insure drainage, and it can be flushed with hose when cleaning is desired. On the loading platform and against the side wall of the stock house is a series of steel lockers with doors of heavy grating, and on each of these is the number of a vehicle. In these lockers are placed packages and materials taken from the stockroom as the orders are received during the day and so a portion of the loads is practically made up during the absence of the vehicles, and the loading time of the drivers and the machines or wagons is decidedly reduced. The lockers will not contain a vehicle load, but in them all small orders can be placed. The large packages are made up and left in the shipping room ready for the drivers. This system gives each vehicle a loading place at the platform, and as 45 can be loaded at one time this eliminates confusion or uncertainty and very greatly econ-

omizes time. Doors give access to the platform at frequent intervals and handling is minimized. With these facilities loading may be done in practically the same time during winter or summer, and an enormous volume of freight can be handled during a day. The loading shed is well lighted by day or night, and with three entrances from the street end there is neither delay nor confusion in entering or leaving.

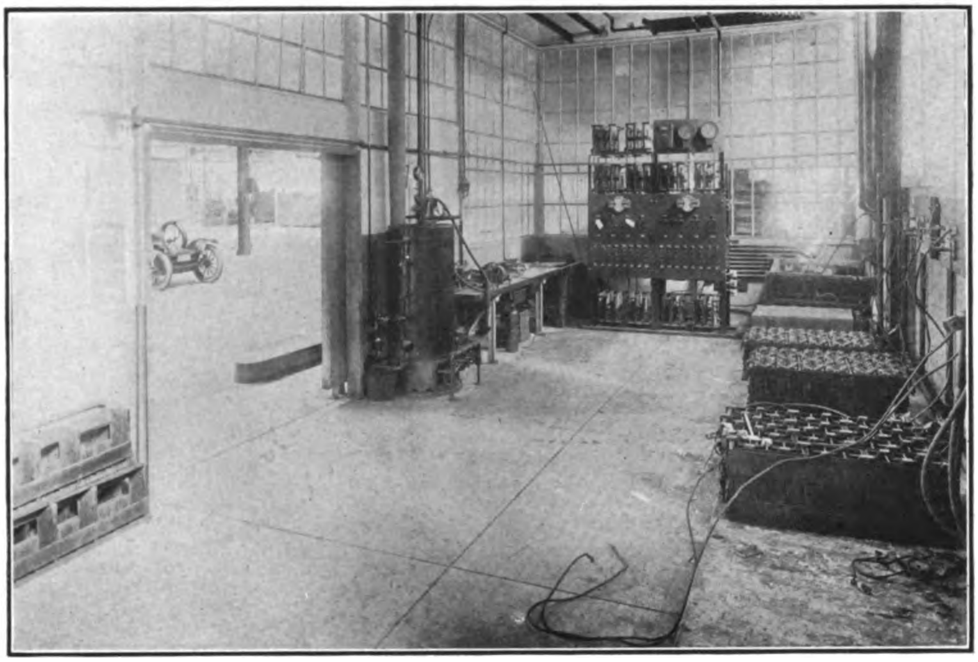
Provision for Gasoline Machines.

The garage building is 316 feet length and 110 feet width, and has a floor area of approximately 52,360 square feet. The three-story section is separated from the single-story portion by a heavy fireproof wall that is in line with the end of the loading shed. The end seen in the illustration is given over to the garage for gasoline machines and the repair shops, and the floor area is 80 by 110 feet. The rear part is the garage for the electric vehicles and is 236 by 110 feet. As stated, the construction is reinforced concrete with a large part of the gasoline garage walls made up of windows, making the interior extremely light, and greatly facilitating the work done during the day. In the centre of the end nearest the laboratory is a tower that contains the hoist for the mammoth electric elevator, 22 by 11 feet, that serves all three floors. The concrete floors of the buildings are supported by large pillars of the same material.

This building has no basement and the entrance to the main floor is in the centre of the end at the main drive between the garage and the administration building, and aside from the office of the head of the automobile division, an oil room and a passage to the electric garage, and the walls that enclose the iron staircase to the upper stories, the main floor is clear for the storage of vehicles. In the centre of this floor is a washstand, drained from the centre, with gang lights that may be placed at any height to permit the washers to have the best of light and on any part of their work desired. In this section is a 300-gallon water tank, suspended from the ceiling, that is heated by electric energy, from which hot water is available, when the boilers in the power plant are shut down, in any reasonable quantity. The oil room contains three portable measuring tanks lined against a wall, which may be filled from a carrier on which a barrel may be raised from the floor and drained into any given tank. The room is protected by fireproof glass windows and walls, and in the event of need the tanks may be removed to safety almost instantly.

Half the second floor of the building is given over to storage of cars, and this section has a washstand with similar lighting; a room for the drivers to lounge in while on or off duty, a lavatory, a shower bathroom, a locker room for the drivers, a room fitted with storage and drying racks for robes and similar equipment, and a dormitory of four rooms furnished for the use of the car dispatchers. The third floor contains at one side of the elevator shaft the stockroom for parts and material and the machine shop, the shop being equipped with lathes, presses, grinders, shapers and other machine tools.

This equipment is such that practically any work can be done that might be necessary in repairing, overhauling or rebuilding a gasoline or electric vehicle. On one side of the floor all of the overhauling is done, there being space for eight vehicles side by side. Along the wall is the work bench with ample space for the workers. The centre of the floor is clear for moving the



The Battery Room, Showing the Concrete Platform at the Right, the "Hospital Board" for Test and Experimental Work, Fitted with Recording Meters, the Workshop and the Steam Boiler.

vehicles. Two portable cranes are part of equipment.

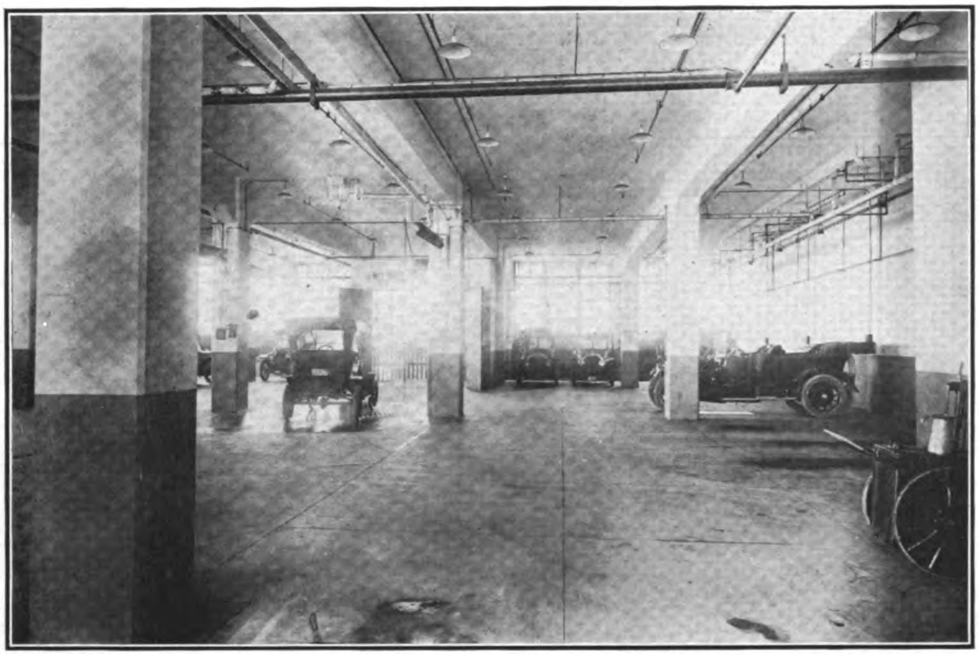
At the other side of the building in the place of the stockroom and machine shop is the blacksmith shop, which is isolated from the remainder of the floor and communicates with a passage open to the air, and there is a pickling room where parts are given a hot potash bath for cleaning, overhead trolleys and chain hoists making for easy handling. This room also communicates with the open air. The purpose of the open air communication is to eliminate all possibility of explosive vapor accumulating. The repair department is arranged as is the overhauling section, and with every facility for the workers. Besides admirably designed heating and ventilating systems the workmen have a large washroom and a lavatory. One of the features of the shops is the lighting, it being equipped with fixtures so that light can be so centred on any part of any

work that there is even better illumination by night than by day. On this same floor is the paint shop and the varnish room, both of ample size.

The garage is a model from every point of view and is planned to store 50 machines with sufficient space about them for work and attention. Every facility that will simplify the work, safeguard the property and contribute to the welfare of the employees has been adopted. One of these is an automatic door to the main floor that can be opened or closed by pressing a button in the office, which is done at a horn or bell signal from the driver. The gasoline is supplied from a large tank buried outside of the building. With the isolation of the lubricating oil tanks there is practically no danger of any kind from fire, but the building is provided with a very complete sprinkler system and with standpipe and hose, as well as with hand extinguishers for protection.

The electric garage is a single floor of practically 26,000 square feet, covered with a roof supported by trussed girders and two lines of angle steel columns. These columns are at frequent intervals and the aisles between them, the length of the building, are approximately 16 feet width. Entering this through the door from the gasoline garage the right wall is broken at intervals by doors to the drive between the building and the stock house. The doors are hinged at the top and are balanced so that they may be raised or lowered with practically no effort and almost instantly. At the left side of the floor, about midway its length, is the charging switchboard and the battery room. These are enclosed by concrete and glass partitions, the glass being largely of fireproof construction. Between the sections housing the switchboard and the battery room is a fireproof partition.

The roof is built with several sections of fireproof glass so that, with the windows at the left side and the end, and the doors at the right, the lighting is admirable by day. The floor is concrete, with four large wash stands that will each accommodate two machines. This floor may be flushed with a hose to insure cleanliness. The heating is by steam with radiation from wall piping. At the walls, at the side, between the doors and at the end, and located on the angle steel pillars, are the charging stations, 110 in number, and these are designated by two numbers. The circuit number corresponds to the circuit number on the switchboard, and at each station, suspended over the vehicle space, is the number of the machine assigned there. Each vehicle number is also posted with the circuit number at the switchboard, so that the charging operator may know at a glance the vehicle being charged or served by any particular circuit. In combination with each station is a wattmeter, that registers the volume of current supplied to each vehicle in charging. Between each door at the side and on each post are four stations, each of which is operated by a knife switch. Overhead the girders carry the lighting and the sprinkler systems.



Section of the Ground Floor of the Gasoline Garage, Illustrating the Location and Equipment of the Washstand, and the Lighting and Fire Protection Installations.

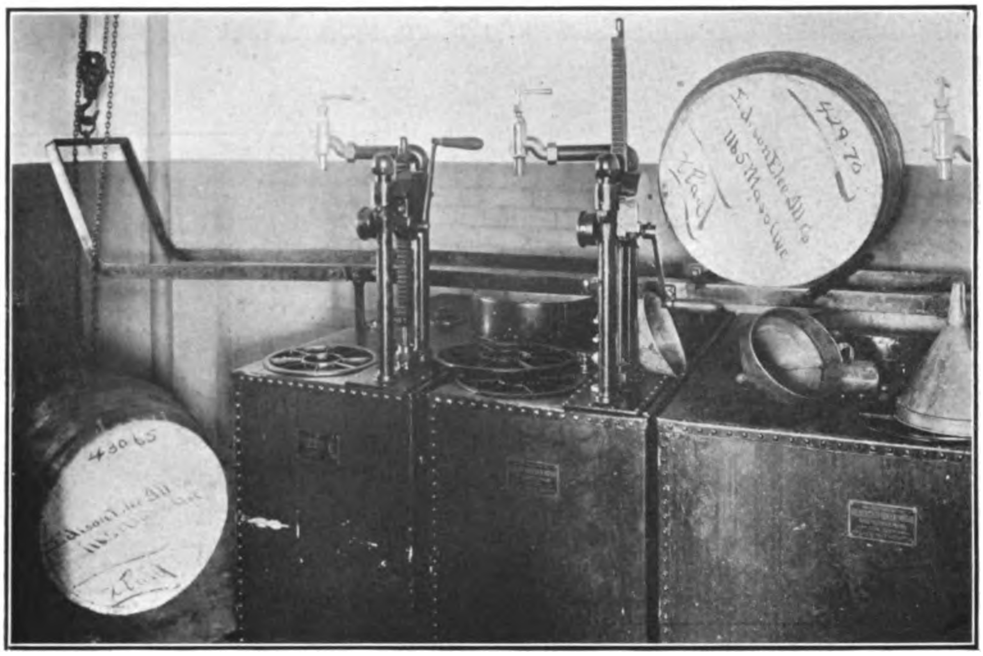
The Charging Facilities.

The switchboard room floor is elevated above the garage floor and on this is placed the board, which consists of eight panels, seven of which are now in use. The circuit lines are under the floor in conduits and are carried from a terminal conduit through porcelain outlets and are connected with the board. The connection is made with a bus bar through fuses that are in plain view, as may be seen from the photograph of the rear of the board, and each circuit is numbered plainly so that it may be located at a glance. The terminal conduit is built to permit a considerable extension of the board without additional construction outside of the installation above the floor. The board is practically in the centre of the floor, with a wide space behind it, and frames carry the resistance, which is so installed that any section may be removed at will without affecting any other part of the board, and any portion is as accessible at the back as at the front. The value of this construction is apparent and will undoubtedly result in a great saving in time.

It will be seen there are four bus bars in the switchboard, and this is accounted for by the fact that the board has two separate circuits which have two separate voltages. The change from the low voltage to the high, or vice versa, is made by throwing the heavy knife switch that is shown near the base of each panel in front. The low voltage circuit is what may be termed normal at 90 volts, but this may be varied at

the power house from 70 to 100 volts, and the high circuit, normal at 130, may be similarly varied from 90 to 140 volts, so that the range of voltage may be as much as 70 volts when necessary, and adapted for any particular service.

This voltage may be varied with reference to any panel, and as the circuits are grouped to the panels for the classes of cars to be charged, variable voltage, from one extreme to the other, may be provided on two adjoining panels. The variation in voltage is secured at the power house by varying the field resistance of the generators. By this construction it will be seen that the line resistance and the battery resistance can be overcome and high voltage secured whenever it is needed, and when high voltage would mean a large loss in the rheostats it may be changed to a lower rate and this in turn varied to as low as 70. The value of this construction is in the large saving in current, which economy can be understood by all electricians, especially when the number of batteries to be charged is large. This may be explained more clearly by stating that when a line has a voltage of 115 volts, for instance, there may be line and battery resistance that lessens the actual charging voltage to perhaps 110 or 109. When a lesser rate is desired this is secured by the rheostats, and though the full line voltage is used, a part of the energy, in excess of the voltage used in actual charging, is lost or consumed by the heating and consequent radiation of the resistance.



The Lubricating Oil Room, Equipped with Hoist and Carrier for Handling Barrels, and Quickly Removable Measuring Tanks.

The switchboard construction and the manner in which the details have been worked out can only be referred to briefly in this article, but it will be understood that when the garage has a capacity of 110 cars, with the voltage requirements varying greatly, and with machines with batteries of numerous types, the advantage of grouping them with reference to charging, and of minimizing current loss, means a very large economy in the course of a given period as compared with charging through a line of fixed voltage.

The Battery Room.

Of about the same size as the switchboard room is the battery room, and especial attention is directed toward the illustration of this department, which shows the construction of the partitions, insuring ample light, as well as the provisions made for work. In this picture is seen at the right a concrete bench for the batteries, where they can be worked on conveniently and where they can be charged from outlets located on the wall. This bench will take a dozen batteries side by side and all can be worked on at once if necessary without crowding the workers.

At the further end of the room is what is known as the "hospital board", which is a charging panel of two sections, each carrying a wattmeter, a voltmeter and an ammeter, the last two being of types that make chart records. With this it is possible to take a battery that is faulty or defective and by means of the charts note all the characteristics in charging and discharging, make any tests or experiments, and make comparisons to determine what work is necessary to restore normal efficiency. By this, also, it is possible to make tests from time to time of batteries and ascertain the degree of lessened capacity. The general purpose of the board is to ascertain absolutely certain records, which are regarded as far more satisfactory for experiment, development and reconstructive work than any other method, especially where so large an investment is made and where efficiency so greatly depends on the serviceable condition of the batteries.

At the left side of the room is the work bench and the boiler, the latter being used to generate steam with which to cleanse the Edison batteries of the accumulations of encrusted potash. This steam is used under pressure and is worked with a hose. At the other end of the room is a stock department with a number of open bins, a water still that will produce 300 gallons of distilled water daily, and a small charging panel where a single cell to 10 cells can be tested, charged or discharged, the generator working as low as one volt. The rooms below the windows are of fireproof material and the floors can be flushed and kept clean. The doors of the battery room are a sliding type, while those of the switchboard room swing and are kept closed by spring hinges.

The garage is equipped with a thorough fire protection service of standpipes, hose and fire extinguish-

ers in addition to the sprinkler system. Close to the switchboard room is an air compressor that affords a constant pressure of 90 pounds for cleaning and tire inflation. There are two entrances through the rear end wall to the grounds independently of the drive. As may be assumed, the vehicles are taken from the garage directly to the loading platform, and there is no possibility of delay so far as the service depot is concerned.

Motor Vehicle Equipment.

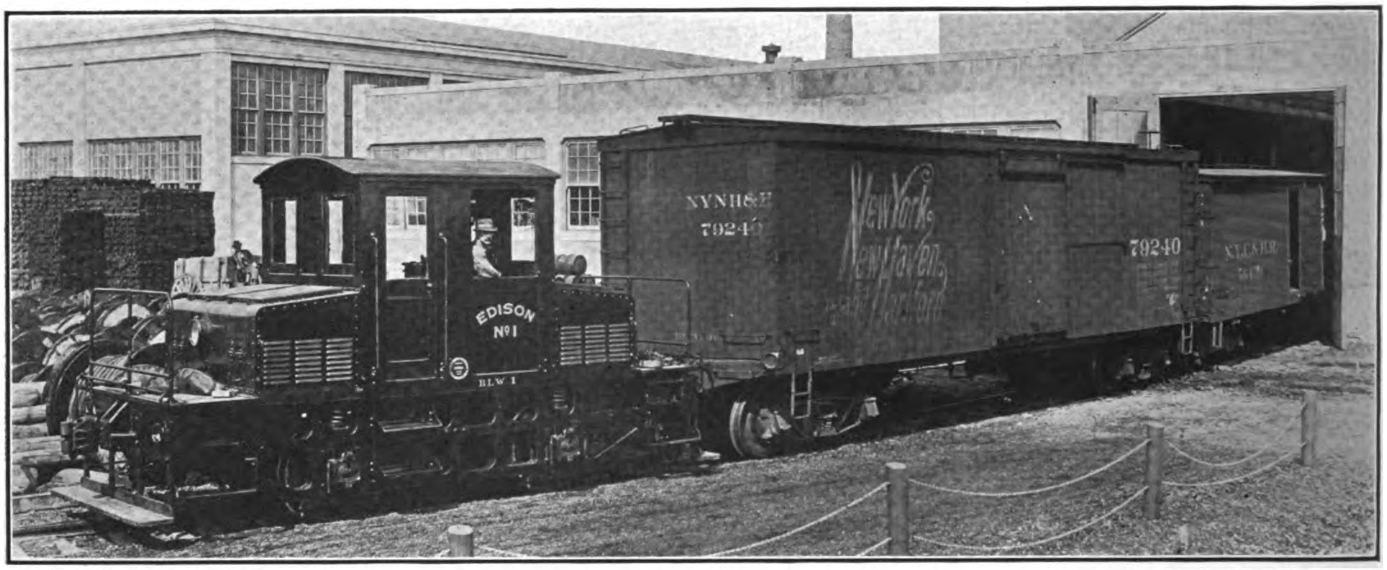
The equipment of the company now consists of the 110 vehicles in use and 33 on order, some of which may have been delivered since this article was written, so that the total that will be in use in a very short time will be 143. Taking up the electric machines first, these include 17 700-pound wagons, 10 1000-pound wagons, one 1500-pound wagon, five 2000-pound wagons, one 3000-pound wagon, two 4000-pound wagons, one 3.5-ton truck, one 10,000-pound truck, one 12,000 pound truck and 22 two-passenger cars. Orders have been given for 11 1000-pound wagons, two 2000-pound wagons, 11 4000-pound wagons and a four-passenger car, this making a total of 60 machines at work and 25 ordered, a grand total of 85. The gasoline equipment consists of one 1500-pound wagon and two 3000-pound wagons in service, and one 3000-pound wagon ordered. The company has 37 different cars in use and seven ordered, making a total of 50 in service and eight ordered.

Of these machines 71 electrics will be kept at the garage and 11 wagons, five 700 pounds, one 1000 pounds, one 1500 pounds, four 4000 pounds and three two-passenger cars will be kept in outside garages, and one 1500-pound gasoline wagon and 12 gasoline cars will be kept outside, and 42 gasoline cars and three wagons will be kept at Massachusetts avenue. The total kept at the garage will be 116, and the capacity is 160, so it will be seen there is ample room for expansion without crowding or congestion in any of the departments.

Machines Garaged Elsewhere.

The fact that 27 machines, 12 of them wagons, are, or will be, kept outside of the garage, may require explanation. In view of the facilities and economy of the central depot the supposition might be that all vehicles would be kept there, but when the area of the territory is realized and the needs of the construction, maintenance and contract departments are understood, the reason for having these wagons and cars stationed in the districts, where very valuable time may be saved, is apparent. These vehicles are kept at garages where they are ready for service and may be reached very quickly at such times as they are not in use. These machines are handled by regular drivers, who may be considered on call at all times when off duty, although in the event of need others may drive. The vehicles are in some instances long distances from the service depot, and quite as essential as the carrying of material, supplies, etc., is the possibility of supervision, for men in charge of work can direct gangs working in different places and decidedly economize. Were it necessary to send the materials each day from Massachusetts avenue a great deal more mileage would be required, and unless men were stationed in the districts, with machines for travelling where the transportation facilities are by no means as satisfactory as in the city, it would be impossible to have the desired oversight without a considerable increase in men. For these reasons the number of passenger machines is seemingly large.

There is no reason to believe that the company will have small garages in the different sections where machines are kept, for such a policy would require too great expense for the service. It is probable that the system will be continued as outlined, and the service garage fleet will be added to as required. But the additions in the districts will be single vehicles as a rule, and there will be no further endeavor to centralize the equipment. Incidentally, mention should be made that the company now works 90 horses, principally in



The Electric Locomotive Used for Moving Freight Cars in the Yard of the Service Depot and on the Sidings That Are Near the Plant.

Boston, and 25 of these will be disposed of when the machines on order have been received. The expectation is that the entire equipment will soon be motorized.

The first motor vehicle equipment of the company was a Columbia electric runabout, that was purchased in 1903, and the following year five electric machines were added, these being a 1000-pound wagon, a 2000-pound wagon equipped with a pump driven by a gasoline engine for pumping water from manholes, a three-ton truck and a five-ton truck, the latter being fitted with winches for hoisting and heavy work. The company then boarded all its horses in stables in several parts of the city, and when the electric machines were bought the company established an electric garage at 516 Atlantic avenue, which was later transferred to the jurisdiction of the committee of the Electric Vehicle Club, and subsequently turned over to the Electric Motor Car Club of Boston, and conducted as a public service station.

Because of the limitations of the electric garage and that the company deemed it advisable to segregate the gas and electric machines, a garage for gasoline cars was established in Stanhope street, but later this was increased in size and the electric machines were kept there after the transfer of the Atlantic avenue garage and pending the construction of the Massachusetts avenue plant.

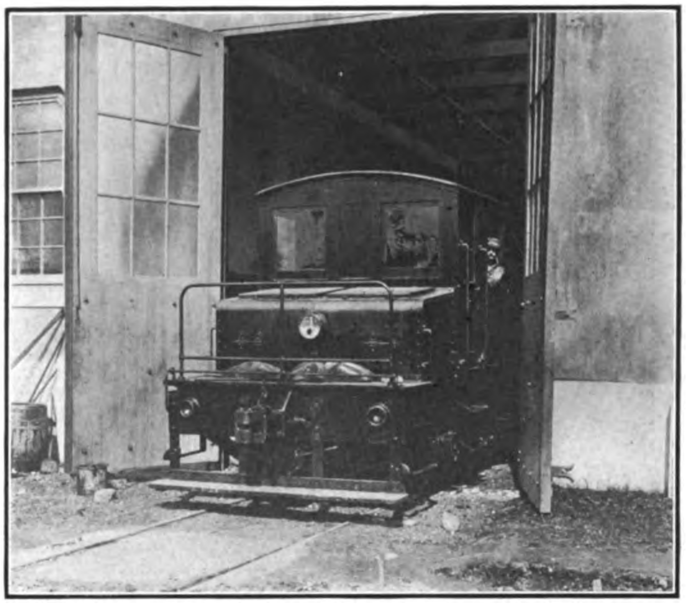
How Machines Are Utilized.

The system of the company as indicated by the map shows seven district organizations, and as stated these have pole yards conveniently located for the distribution of the poles. Up to a radius of approximately 10 miles the distribution of stock, material and supplies required for construction and maintenance is delivered by machines daily from the Massachusetts avenue service depot, but beyond this the deliveries are made periodically to the sub-service stations for the construction and maintenance departments, and still further out to sub-service stations for all departments. In the routine distribution the wagons have regular trips that are covered daily, these serving the outlying districts with supplies, but all emergency requisitions are filled by special trips. The meter wagons are required to make regular trips, each having such assignments as will constitute a day's work, and where occasion requires additional wagons or trucks are hired to do work in excess of the capacity of the regular equipment. In the event of the haulage being done by railroad the cars are loaded in the yard, hauled to the siding and the railroad notified.

All the haulage of supplies, express or freight receipts or shipments, is work done by the teaming division, so-called, of the transportation department, and the handling of the freight cars is also included in the work of this part of the organization. The haulage for the different departments, aside from that specified, is done by the different departments by vehicles that are operated by the transportation department, but this service is charged at definite rates to these departments. Wagons are assigned to different departments and are under the jurisdiction of the heads of each, but are maintained and their service is practically contracted for with the transportation department, so that the departments bear the expense of whatever work is done by these vehicles.

The Operating System.

In explanation of the system it should be stated that when a department requires a vehicle application is made to the purchasing bureau, and after the proposition has been considered by the heads of the department, the purchasing bureau and the transportation department the purchase is authorized. The vehicle is then assigned to the department and is charged for at a fixed daily price, which may or may not include the wages of the driver. Drivers having work of this character take their orders from the department heads and not from the transportation department. Such work may be for the lamp department, meter department, for the use of trimmers, for patrol duty, and the like, or for the use of the officials and engineers. The charge made for the use of a machine includes all operating expense and driver's wages and the maintenance and fixed charges, including depreciation. If an extra vehicle is provided at any time this is charged at a daily rate, but in the event of withdrawal from service for any cause the replacement is charged at the averaged cost. If an extra trip is made this is charged at an hourly rate. It will be seen that wherever possible the department is charged specifically, and only where this cannot be done is a general charge made.



The Stall in the Stock House That Serves as a Garage for the Electric Locomotive and Unloading or Loading Platform for Freight Cars.

As stated, all motor vehicles are under the direction of the head of the automobile division. All machines purchased are those that in the opinion of the superintendent of the transportation department are best suited for the requirements. If a driver is supplied by the department he is carried on its pay roll, and is under its control, but a driver may be employed

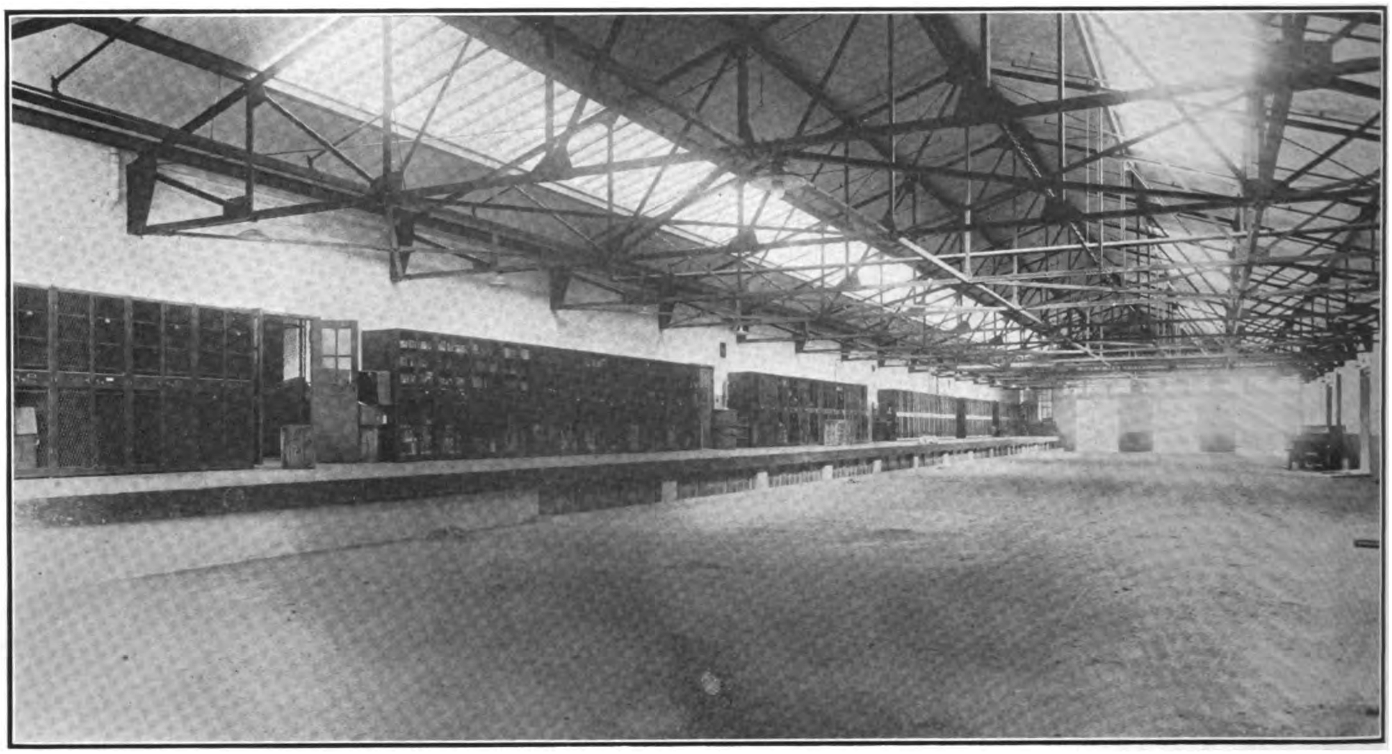
and controlled by the department in which he serves. When a machine is purchased the detail of it is entered on an inventory card that is placed in a perpetual file. Record of the machine is entered in all the forms that may be required of it, and these are carried until the vehicle is disposed of.

Dispatchers and Drivers.

The operation of the division is directed by the head of that division, who receives his instructions from the superintendent of transportation. In the garage is stationed the car dispatcher, who is on duty eight hours at a watch, and there are three watches, so that a dispatcher is constantly at the switchboard, with four men doing this specific duty. Each dispatcher is a thoroughly experienced driver, and should there be a call and a driver is not instantly available, a call is made for another dispatcher, and the man on duty calls a garage man to take his place temporarily and he will take out the car that is called for. The dispatchers have a dormitory in the garage and each man is on duty 16 hours daily, eight hours at the switchboard and eight hours on call, to insure against any emergency. In the event of a fire or any need for the attendance of any special men cars are sent out instantly to rush them to the place where their presence is required, their cars being used if they are available, and other machines if they are not. Notification is given the general manager and his instructions are carried out, besides the usual requirements of the organization. The car dispatchers have important work and the switchboard cannot be left unattended. Besides providing machines for the officials and others when an emergency call is received, drivers are notified, and the entire transportation department's force can be summoned with great rapidity. The dispatchers in the course of routine work direct the drivers so far as ordinary needs are concerned, giving the orders received from the superintendent or the different department heads.

The drivers report at the garage for daily duty and on taking out their machines stamp a time card in a clock for themselves and one for the machine, so there is a record of both vehicle and driver. When instructed to do so the drivers report by telephone, but otherwise they complete their work before returning. On arrival at the garage the driver and the vehicle record is again made on the cards. The card records are in addition to the entries made when the machines are taken from or returned to the garage, such entries being required by law.

On the arrival of the driver or user of a machine at the garage report is made of the condition of the vehicle, the assumption being that it is satisfactory in operation in the absence of statement to the contrary. But the washers, polishers, oilers, batterymen and others working on the cars and wagons are expected to make report of any condition that may require work to insure serviceability. Should breakage, wear, loss or any other cause require attention, report is made to the garage foreman on a repair tag, on which the precise condition is stated and placed in a special rack. The superintendent usually sees these tags, but the foreman takes them, inspects the vehicle and then assigns the work to a man or men if it can be done in a single night and the machine made ready for service the next day. What are known as "repair" jobs are done by the night force of men in the repair shop, and the overhauling and large repair jobs by the day shift,



The Splendid Covered Loading Platform Between the Electric Garage and the Stock House, 10 Feet Width, on Which Are the Load Lockers—The Drive Is 60 Feet Width and 236 Feet Length, with Closed Ends, Each End Having Three Entrances.

so that the shop is always busy and men are on duty constantly, six of them at night. On the repair tag is noted the usual information with detail of the time required and the materials used.

Should there be a road accident of any kind that will prevent the operation of a machine the report will indicate what is required. If a road repair can be made a mechanic with the necessary tools is sent out. If spare parts are required these are taken. If the vehicle can be made operative this is done, but if not such work is done that it can be towed to the garage. If necessary the load is transferred. An emergency wagon is always in readiness for calls of this kind and men are available from the garage or the repair shop.

When a machine is withdrawn from service for overhaul another replaces it and usually two weeks' time is taken to practically renew a vehicle and restore it to first class condition. But if an old car, wagon or truck that is to be replaced by another, such work is done as will make it saleable. At regular intervals the machines are inspected, both in the garage and on the road, the last work usually being done on vehicles that are stationed in the districts and are not often in the garage. The reports usually determine the overhaulings.

The district service cars and wagons are given attention in the garages where they are stationed. Daily readings of the odometers and daily charging reports are sent in to the head of the automobile division, and daily oiling records are also kept.

In the daily work on the machines, washing, cleaning, polishing, replenishments of fuel, water, oil, electrolyte, supplies used, such as waste, alcohol and the like, record is kept of the supplies drawn from stock and, so far as is practical, used for each vehicle. The miscellaneous labor on the automobiles in giving the care and attention in the garage, as well as the materials and supplies, are computed and the expense divided pro rata.

The System Summarized.

Summarizing the system of administration: The machines are charged to the department at stated prices, inclusive or exclusive of the driver's wages. In the event of repair the job cards show the time and material used for the job and after being figured by the garage clerk they are sent to the clerical division for entry in the journal. The cost of each repair is figured on the job card, the time of starting and finishing the work being shown by the time clock stamps.

All supplies are drawn from stock by requisition which, after being priced, are entered in the journal against the machine on which the supplies were used. Some of the supplies and expenses, such as oil and waste, repairing tubes, labor of washing and polishing, etc., are charged to general accounts and pro rated at the end of each month. Whenever possible, however, each item of expense is charged directly on the journal to the account in which it is carried and against the vehicle for which the expense was incurred. The journal is a loose leaf book with a number of sheets for each machine equal to the number of accounts shown on the car ledger. At the end of the month the journal is footed and the totals carried to the ledger for that specific month, and the departments are charged as the accounts require.

The records show a form for the tire, which is filled when the tire is purchased and when a tire is installed the record will show the vehicle and the serial number branded on pneumatic shoes, or the wheel numbers if the tires are solid. The records include what may be termed a history of the tire, that is filled from time to time from the date of withdrawal from stock to the date of disposal. The garage record differs from the office record in that it deals particularly with the service. Both the garage and office records for tire adjustment show detail facts that are essential in working out the eventual cost of service, which is kept for each mile for every tire used.

For the exact information of the reader the forms used by the company in its transportation department have been reproduced on a special insert sheet and these are numbered in approximately the order in which they are used in the records. The numbers on the forms, however, are for the benefit of the reader that he may readily find that which he may seek, and these numbers correspond with the numbers given in the brief explanation of each that follows. These forms are practically self-explanatory:

Description of Forms.

When a vehicle is required for use in any department of the company a request is made to the purchasing bureau of the company by the head of the department, and if this is necessary for continued use an authorization for purchase is made out and submitted by the purchasing bureau to superintendent of transportation, and when this has the approval of the department, the purchasing bureau and the superintendent of transportation, the vehicle is bought.

Form No. 1 shows the authorization necessary for the purchase of a specified motor vehicle. This states the use to be made of the machine, whether with or without driver, the account to which the charge is to be made, the classification of the machine and the rate to be charged the department, plus the driver's wages and other expenses.

Form No. 2 is the team authorization, which is similar to Form No. 1, stating the department in which it is to be used, the class of team, whether with or without driver, the number of the account to which charge is made, and the price to be paid weekly.

Form No. 3 is the file record of the automobile, on which is entered the detail, giving the company's number, the manufacturer's number, the registration number, the horsepower, the date purchased, the type of machine, the name of the manufacturer, the cost of the machine, the cost of the equipment in detail, the assignment, the name of the driver and the license number, the amount of depreciation annually, and with space for changes of driver and license number. When the vehicle is sold this is also entered, with the name of the purchaser and the price paid by him.

Form No. 4 is the record of a wagon, showing the company's number, the date purchased, whom it was purchased from, the cost, a brief description, where it is to be located, and the date of location, with space for recording transfers and the dates, the assignments and the date. When sold the name of the purchaser and the price is also entered.

Form No. 5 is the record of a horse, showing the animal's number, the date and from whom purchased, the cost, a description by color, weight, where located, with space for subsequent transfers and the dates, the assignments and the dates. When sold the name of the purchaser and the price is entered.

Form No. 6 is an order for a team, which is an order on the transportation department for a horse and wagon or horses and wagon, which is a departmental requisition for such equipment as may be needed for a given work, stating the time, place and to whom the driver shall report, and the character of the work, which is filled by the head of the department and

approved by the superintendent of transportation. This is a record of special work, and accounts for the time of the driver and the equipment.

Form No. 7 is a teaming ticket, on which all charges are made to the different departments. This indicates the person and the department authorizing the use, the detail of the use, the date of use, the time and the debit, whether the work was teaming (general haulage), freight or express. When this has been approved by the head of the department charged with the work the ticket is sent to the purchasing department and goes through the regular course for audit. The ticket is printed in duplicate, one copy being retained by the department and the other is sent to the transportation superintendent.

Form No. 8 is the regular garage record required by law on which is entered the time of the departure and the time of return of all vehicles, but this form is also used for other record because it indicates all the machines owned by the company by number, and it is a convenient sheet for noting facts that may be desirable.

Form No. 9 is a record of the daily odometer readings of all vehicles stationed outside of the Massachusetts avenue garage of the company, and these are sent to the head of the automobile division for the mileage record.

Form No. 10 is used for recording the daily mileage record of the vehicles and also for recording the daily gasoline consumption, either use being designated by writing one word in the form, for a period of one month. Each sheet will permit the record of 31 vehicles. This is a garage and an office record.

Form No. 11 is used to record the special work of any vehicle for from one to four trips, showing the time of leaving and return, the time in and out of the garage, and the total mileage and the place to where the trip was made, as well as the number of passengers.

Form No. 12 is a record of the service of any vehicle used nights, Sundays or holidays, and this gives the number, the class of car, the date, the department to which the vehicle is assigned for the work, when it was taken out and by whom, when it was returned and by whom, the number of passengers, remarks and the condition of the machine. Each form is signed and is returned to the transportation department. The record is made in duplicate.

Form No. 13 is a requisition blank that is used by all divisions of the department and it may request either purchase or sale, with such explanation as may be desirable. It is signed by the person making the request and in addition indicates the records on which it is subsequently entered, the account and the vehicle for which requisition was made. This is made out in triplicate, and it bears a serial number, by which it may be filed.

Form No. 14 is a receipt for material received from the different departments of the company for transportation by any express company, and is made out in duplicate.

Form No. 15 is a regular card used by the employees of the garage, either drivers, mechanics or laborers, and on it is stamped the time of arrival and leaving for morning or afternoon, with lost or overtime, and on this is also entered the time in hours and minutes, the rate and the total wages due for any given week or less.

Form No. 16 is the regular card that shows the time of the vehicle in and out of the garage, and is stamped in the time clock, and covers a period of one week. This is kept against the number of the machine.

Form No. 17 is used for entering the record of any battery used in the electric machines, each of the batteries being given a number. This indicates the date of installing in a vehicle, the vehicle number, the meter number, the reading, the odometer reading, by whom the reading was taken; the date removed, the meter number and reading, the odometer reading, the mileage and the kilowatt-hours, by whom removed; the date of equalizing, of washing, the capacity if discharged, and the date it was ready for service with remarks. This is signed by the battery man doing the work.

Form No. 18 is used for entering individual battery reports, showing the date, vehicle number, battery number, the readings of the ampere-hour meter and the wattmeter at the starting and finish of charging, the odometer reading, the wattmeter number, the kilowatt-hours of current indicated, the miles run by the vehicle since the previous charging, the ampere-hours of current used in charging, the driver of the machine and the road conditions, together with the usual record of voltage and amperage at different times, and by whom the readings were made and remarks.

Form No. 19 is for charging records of vehicle batteries in groups of 10, covering the voltage and amperage readings for 16 different periods, or half-hour intervals during a normal charge of the batteries. This is a small sheet and is convenient for handling.

Form No. 20 is designed for taking half-hour readings of a battery at any given voltage or amperage, from 76 to 119 volts and from three to 46 amperes, the blank being ruled so that the voltage and amperage may be varied as desired. The record states the number of the battery, the number and size of cells, the make, and the number of the machine in which it is used. This is used generally in testing and forming, it affording a very accurate statement of the charging conditions.

Form No. 21 is the record of the oiling and greasing of each machine and covers a period of one or more months. This is a loose leaf sheet that requires 23 different entries, each showing that a specific part of the mechanism has been given attention, and the odometer reading, which indicates the distance driven between each work. For instance, one date may show but one part of the vehicle was oiled, another any number or all parts, and the odometer readings will indicate whether or not efficient care was given. The man doing each work signs his name and is responsible for the condition of the machine with reference to the work he does. This record is kept for each machine and in binders.

Form No. 22 is for the use of the inspectors of the motor vehicles, and is a complete record on each machine, whether gasoline or electric, and when filled is in duplicate. This provides for both garage and road inspection, and indicates the condition of different groups of mechanism, the accessories, the permanent and temporary equipment, tools, and with reference to cleanliness. These reports are made to the head of the automobile division and from them instructions are given as to care, repair, attention or other requirement. These inspections are made at regular intervals, or at such times as in the judgment of the head of the automobile division as may be expedient, or upon the road.

Form No. 23 is a repair card and it is used for all work on machines other than cleaning, oiling, adjustments and the like. This indicates the number of the vehicle, the date report was made of needed repair and the date the work was completed; the nature of the repairs, and by whom report was made; the time required for the work for seven days and the total time for each day, the number of the account to which charge is made, the rate of labor by the hour, the total cost, and by whom the repairs were made. The reverse of the card shows the vehicle number, the date and the repairs made.

Form No. 24 is a filing card for the convenience of the superintendent of transportation and it is filled with data on overhauling and painting, showing the make of vehicle, the type and the number, the dates of withdrawal and return to service, days out of service, days in repair shop, days in paint shop, average cost of labor an hour, inside labor and outside labor (such as trimming, etc.), new parts and painting, etc., and the total cost. This card will permit four entries.

Form No. 25 is a tire record, begun when a tire is purchased and ended when the tire is no longer serviceable and is disposed of. This requires entries of the size, type, manufacturer, date bought, cost and the number, the dates of putting on and the numbers of the car, the dates of removal, the causes, condition, miles run, estimated mileage remaining, total mileage, cost of repairs and credit value; the total mileage obtained, the total cost, the average cost a mile and explanations or comment. This is the office record.

Form No. 26 is the garage record of a tire and is prepared for loose leaf binding. This gives the tire number, the make, size and style, the number of the vehicles on which it is installed, the date, the odometer reading, the mileage, the dates sent for repairs and the cost of repairs, as well as notes on conditions, etc. This blank provides for four installations on one or more machines. The blank further shows the adjustments, the total mileage run, the total repair cost, the price of the tire, the credits and the actual cost.

Form No. 27 is a heavy tag which is a record of tires installed or removed, and from which the garage and office records are in part made up. This requires entries of the date received, the number of the tire removed, the number of the tire put on, the wheel, the number of the vehicle, the odometer reading, the reason of removal, whether drawn from case or from stock, whether new or repaired, the make, style, manufacturer's number, the date it was placed in the case, whether it is repaired or new, and by whom the change was made.

Form No. 28 is a filing card and is the tire record of the horse and wagon division and it relates to tires used on wagons, showing the wagon number, the wheels used on, the dates put on and the cost, together with remarks.

Form No. 29 is the garage record of the adjustments made with the manufacturers of tires for motor vehicles, and this shows the name of the manufacturer, the date, the number of the tire, the size, the vehicle number, the miles driven, remarks, the cost of replacement and the cost of repairs. This may contain the record of a considerable number, or may refer to a single day or period, but with one manufacturer. This record is made in duplicate.

Form No. 30 is the office record of tire adjustments, and this gives the name of the manufacturer, the date, the company's tire number, the make, size, tread, the disposal made of it, the miles driven, the cost new and value when disposed of, the weight in pounds, the cost by pound, the charges, the credits and the number of the vehicle on which it is used.

Form No. 31 is a record used for the shipments of express or freight and it is a record of the transportation department, but is not a record of the motor vehicle division or its work.

Form No. 32 is the monthly report of the charging of electric vehicles. This requires an entry daily covering the start and finish ampere meter readings, the ampere-hours used, the odometer reading, miles run, ampere-hours a mile, the start and finish watt-hour readings, the kilowatt-hours of charging, the number of the wattmeter, the time put on and taken off charge, the volt and ammeter readings at normal rates at the end of the charging, the battery number, the road conditions, the name of the driver, if the battery were cleaned, if the battery were flushed, the temperature, and the signature of the man making the entry, together with remarks. At the end of the month the record shows the totals for ampere-hours used, miles run, kilowatt-hours of charging, the averages of ampere-hours output, kilowatt-hours input and notes relative to weather conditions.

Form No. 33 is a disbursement sheet, showing the period covered, the number of the vehicle, the name of the account and the account number, the date, the description and the total of material and labor. The record is kept for each machine.

Form No. 34 is a record of automobile vehicles out of commission. This is kept for each machine and it specifies the period covered by the sheet, the dates of the withdrawals from service and the various causes.

Form No. 35 is a record that shows the distribution of the expense of maintenance apportioned to each vehicle from the different accounts. This shows the total expense figured against each machine, the amount from each account being placed in a separate column, from which comparison or deduction may be made.

Form No. 36 is the car ledger for the year and this is kept for each machine. This gives the registration number, the manufacturer's number, the date and from whom purchased, the capacity, power, cost, service, the assignment and the department using it. Under the heading of technical data is kept for each month the miles run, the kilowatt-hours input (if electric), the gallons of gasoline used, the number of hours out of the garage and the number of days used during the month. Under the heading of current running costs is entered the cost of operation, maintenance, tires, running repairs, overhaul and painting, cleaning, care, etc.; alcohol, oil, waste, etc.; electricity or gasoline, sundries and the total. Under the heading of fixed costs are entered the office salaries, office expense, garage wages, garage expense, insurance and rent, garage maintenance, depreciation and the total. Next is entered the driver's wages and the total costs. Against this is entered the rental credits in the form of the current running costs, fixed costs and total, these being a summary of the different items. In addition, is entered the loss or gain, the days the machine was in service and remarks. At the expiration of the year the columns are totalled. Below these are shown the average for each column for the month and for the mile, and with the previous cost brought forward from the preceding year the total to date is obtained. The total is then averaged for the month and for the mile. The second section of the sheet, under the caption of averages per mile, contains the averages of each column above it, this reducing to miles the cost of the vehicle. The third section shows the adjustment figures in a similar manner, and these are totalled as are those of the first section, showing the average per month, average per mile, the previous cost, the total to date, and the average per month and the average per mile of the period of service.

Form No. 37 is the analysis of the transportation clearing account (K 202) for a month. In columns are indicated the account numbers, the name of the account, salaries, labor this month, material this month, total credits, total debits, the balance and comment. Under "Horses and Wagons" is the cost of stable board, horse shoeing, veterinary services, running repairs for wagons and harness, overhauling and painting, cleaning, care, etc.; oil, waste, etc.; hay and grain, sundries, office salaries, office expenses, stable wages, stable expenses, rents, insurance, etc.; stable maintenance, accrued depreciation, drivers' wages, teams hired and charges to departmental accounts. Under "Automobiles" is the cost of battery operation, battery maintenance, tires, running repairs, overhauling and painting, cleaning, care, etc.; electricity or gasoline, sundries, office salaries, office expenses, garage wages, garage expenses, rents, insurance, etc.; garage maintenance, accrued depreciation, chauffeurs' wages, automobiles hired and charges to departmental accounts. Both of these sections are totalled. Then is specified the reserve for depreciation for horses and wagons and for automobiles, and the total depreciation, and then the total of the transportation department clearing account.

The following explanation will serve to make clear the accounts of the car ledger. "Battery Operation" covers all items of expense in the daily operation of the machines and small renewals, but "Battery Maintenance" includes only the complete renewals, while "Overhauling and Painting" covers the annual overhauling and all painting, and such other repairs as are carried into the running repair account. The item of "Office Salaries and Office Expenses" covers the expense of the clerical division and the superintendent's office.

Depreciation is on the basis of three years for gasoline cars and machines and six years for all electric vehicles. Referring to the car ledger, the upper portion of the sheets shows the actual costs, but the lower portion the "adjustment figures." The adjustment figures have a specified purpose. In making up the figures for the year or the period the machine has been in use the account may be misleading from the fact that the three items of "tires", "battery maintenance" and "overhauling and painting," which make a comparatively large part of the total expense, do not appear often. Possibly with a new machine these would not appear in the first year, and to show more accurately what the machine is costing the adjustment figures are computed and entered. The depreciation is figured on the entire cost of the vehicle, including tires and batteries, but less the estimated salvage. In the adjustment figures the cost of tires and batteries is omitted. These figures have been worked out completely each month, but when sufficient data have been accumulated it is probable that this will be done but once a year, when the final cost figures are computed.

All the original charges recorded in the books of the transportation department are sent to the accounting department, where the total figures for the various accounts are kept, and at the end of each month a report is submitted to the transportation department, showing the total cost of operation. It will be noted that the statistics show the cost of operating any given vehicle by the mile, day, week, month or year. This information is also kept in a pocket data book, showing the comparisons of the operating cost by month and by year, and these costs are reduced to cost a mile, so that the superintendent of transportation may at any time determine the efficiency of the department.

Over 100 White motor trucks, made by the White Company, Cleveland, O., are used to make deliveries to Pittsburg, Penn., shoppers. Three of the prominent department stores of that city have added White machines to their equipment. The Rosenbaum Company, which has operated seven Whites, placed its order for six more; Boggs & Buhl, Inc., which has operated 10, brought its total to 16, and Solomon & Co., purchased two.

The Commerce Motor Car Company, Detroit, Mich., maker of Commerce delivery wagons, has plans for largely increasing its production the coming year. The company has now more than 300 machines in operation in different sections of the United States, and with the experience of three years, having well established the utility and practicality of the wagons, the purpose is to manufacture them in larger numbers through a well organized and efficient selling force.

BOSTON EDISON COMPANY'S TRANSPORTATION DEPARTMENT OPERATING RECORD FORMS.

The insert facing this page shows the 37 different record forms used in operating the Transportation Department of the Edison Electric Illuminating Department of Boston, each of which is designated by a number shown within a circle, and on this page the use of each form, the color of paper, ruling and printing, as well as the dimensions, are stated. Reference to the insert will show any desired form and its general proportions and makeup, while on the preceding pages a brief description of each may be found. The arrangement of the forms on the insert is not in the order of use, but to convenience reproduction, and the numbers will be found to be so applied as to group the several records of each department. In several instances forms requiring similar entries may be noted, but one of these is for use in the garage office and the other for the office of the superintendent of the transportation department.

This series of forms has been developed from an experience covering years, and the value of each record has been established beyond question. The company has an extremely comprehensive system, and the possibilities of economy are such as to justify what may appear to be without reflection a complex or unnecessarily careful administration.

No. 1, Automobile Authorization, typed in purple on white filing card, five by eight inches, unruled.

No. 2, Team Authorization, typed in purple on white filing card, five by eight inches, unruled.

No. 3, Record of Car, printed in black on white filing card, head rule of red and body ruled with blue, five by eight inches; reverse of card similarly ruled.

No. 4, Record of Wagon, printed in black on white filing card, ruled both sides with blue, five by eight inches.

No. 5, Record of Horse, printed in black on light yellow filing card, ruled both sides with blue, five by eight inches.

No. 6, Order for Team, printed in black on white paper, 5.25 by 8.25 inches.

No. 7, Teaming Ticket, printed in duplicate on white paper and light white card, and numbered serially, five by eight inches; padded.

No. 8, Checking Sheet, the record of vehicles leaving and returning to the garage required by law, printed in black on white paper, ruled with blue, with red vertical lines between the rules enclosing the vehicle numbers, 15 inches length by 8.5 inches width.

No. 9, Daily Odometer Record, for vehicles stationed in suburban districts, printed in black on white paper, 5.5 inches length by 3.75 inches width.

No. 10, Daily Mileage and Gasoline Record, printed in black on heavy white paper, with head, foot and left end rule of blue, horizontal ruling blue and vertical ruling red, 10.25 inches length and 20 inches width.

No. 11, Special Report on Car, printed in black on white filing card, with head rules in red, horizontal ruling in blue and vertical ruling in black, three inches length and five inches width.

No. 12, Report on Car Used Nights, Sundays or Holidays, printed in duplicate on white paper and light card, five inches length and eight inches width.

No. 13, Request for Material, used by all departments, printed in black in triplicate on two sheets of white paper and a light card, with head and foot ruling in red and line ruling in blue, five inches length and eight inches width.

No. 14, Receipt for Material, for shipments made by express, printed in black in duplicate, the original on white paper and the copy on yellow, numbered serially and padded, four inches length and seven inches width.

No. 15, Driver's Time Card, used in time clock, printed in black on obverse and red on reverse of manila card, 5.5 inches length and 3.5 inches width.

No. 16, Car Time Card, used in time clock, printed in black on obverse and red on reverse of manila card, 5.5 inches length and 3.5 inches width.

No. 17, Battery Record Tag, showing installation or removal and condition of battery printed in black on manila card, eight inches length and four inches width.

No. 18, Battery Charging Report, printed in black on white, 8.5 inches length and five inches width.

No. 19, Charging Record of Batteries, to show the conditions at half-hour intervals by volt and ampere meter readings, printed in black on yellow paper, padded, 8.5 inches length and 10.5 inches width.

No. 20, Charging Record of Battery, to show conditions at any given voltage or amperage, at half-hour intervals, printed in black on yellow, with cross and vertical ruling in blue, 15 inches length and nine inches width.

No. 21, Car Oiling Record, printed in black on white paper, head and vertical ruling of red and cross ruling of blue, perforated for loose leaf binding, 11 inches length and 8.5 inches width.

No. 22, Automobile Inspector's Report, printed in black on white paper, 14 inches length and 5.75 inches width.

No. 23, Automobile Repair Card, for use in the garage, printed in black on both sides of a manila card, 5.5 inches length and 3.5 inches width.

No. 24, Data on Overhaul and Painting, for office reference, printed in black on white card with head and foot ruling of red and cross ruling of blue, three inches length and five inches width.

No. 25, Office Record of Tires, printed in black on white filing card, with ruling of blue, five inches length and eight inches width.

No. 26, Garage Record of Tire, printed in black on white paper, perforated for loose leaf binding, 8.5 inches length and width.

No. 27, Record of Tire Installation and Removal, printed in black on manila card, 5.5 inches length and 2.75 inches width.

No. 28, Wagon Tire Record, printed in black on white filing card, with head and foot ruling of red, cross ruling of blue, and vertical ruling of black, three inches length and five inches width.

No. 29, Garage Tire Adjustment Record, printed in black in duplicate on white and yellow paper, with vertical ruling of red and cross ruling of blue, padded, 10.5 inches length and eight inches width.

No. 30, Office Tire Adjustment Record, printed in black on white paper, with ruling of red and blue, 11 inches length and 8.5 inches width.

No. 31, Freight and Express Shipment Record, printed on either side in black on white, with head, foot and vertical ruling of red and cross ruling of blue, cut for loose leaf binding, 11 inches length and 15.25 inches width.

No. 32, Monthly Battery Charging Report, printed in black on white, vertical ruling of red and cross ruling of blue, perforated for loose leaf binding, 18.5 inches length and 14 inches width.

No. 33, Monthly Disbursement Sheet, printed on either side in black on white, ruling of red and blue and of both colors, cut for loose leaf binding, 14 inches length and 13 inches width.

No. 34, Record of Automobiles Out of Commission, printed on either side in black on white paper, vertical ruling of red and cross ruling of blue, cut for loose leaf binding, 14 inches length and 13 inches width.

No. 35, Monthly Accounts Pro Rated Sheet, printed on either side in black on white paper, with vertical ruling of red and cross ruling of blue, cut for loose leaf binding, [illegible] inches length and 13 inches width.

No. 36, Car Ledger Leaf, printed in black on white paper, with ruling of red and blue, perforated for loose leaf binding, 13 inches length and 22.5 inches width.

No. 37, Analysis of Transportation Department Clearing Account Sheet, printed in black on pink paper, with ruling of blue and red, perforated for loose leaf binding, 10 inches length and 17 inches width.

ANALYSIS OF VEHICLE SERVICE.

Scientific Study of Well Equipped and Assumedly Economical Equipment Shows That the Actual Working Hours are Surprisingly Small and Time Is Very Valuable.

THERE is no more important factor in economical transportation than the productive time of the vehicles in service. The best equipment and the most

The Servis Recorder Case as It Is Installed on a Vehicle for Recording Mileage and Speed.

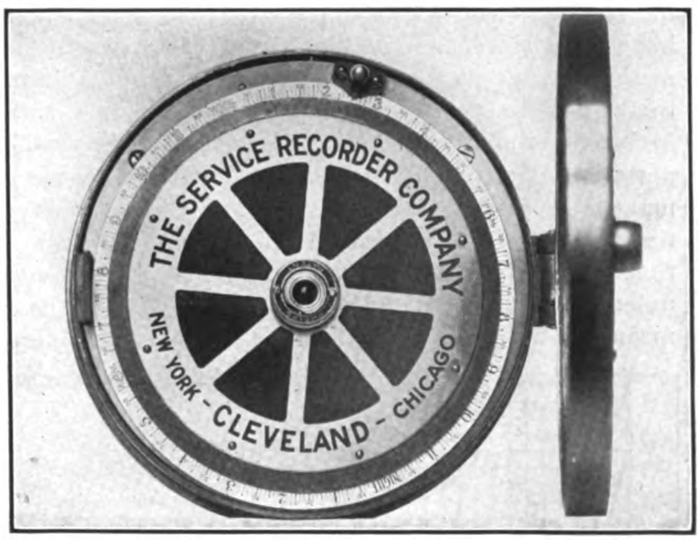
approved facilities are valueless if not profitably used, and when the possibilities for loss are considered the study of actual working time becomes the more significant. By this is meant that a record is without value if it is not used, and if it used then it should be so utilized that it will produce economy to the greatest practical extent.

Probably 75 per cent. of the vehicles used for haulage are in service during what may be regarded as the business hours of the day, from 7 in the morning until 6 at night. The other 25 per cent. are utilized during the remaining 24 hours of the day. Wherever the business interests are large the traffic in the highways is correspondingly heavy and delays from differing causes are material. In practical transportation not half the actual mileage is doing profitable work. Assuming that each vehicle were fully loaded for each trip made, and returned empty, there would still be such work as going from the garage to the place of loading and returning, to say nothing of incidental trips, which would probably reduce the actual work to 45 per cent. of the mileage. There is every reason to believe that this figure is conservative.

Assuming that the vehicle were in continuous service during 10 hours each day, then 4.5 hours would be in productive haulage, and the remainder of the time would be unproductive. The possibility for economy would be to increase the percentage of productiveness, which could not, without carrying loads when returning, be increased to more than 50 per cent., or five hours. This might be accomplished where the garage was in combination with the place of business, warehouse, factory or shop, but this condition is not always possible to develop. In proportion to the decrease of actual haulage time is the loss in productiveness, but it will be seen that the loss of an hour of a 10-hour working day is not a shrinkage of 10 per cent., so it is a decrease of 12.5 per cent of the productive time of the vehicle.

The usefulness of any machine depends upon its operation. This is true of the motor wagon or truck. If there be delays in loading, in driving, in unloading, from accident or any other cause, then this is a direct loss that cannot be made up, and it is well enough known that overloading, or fast driving with or without load, will not compensate for losses through delay, because of the destructive influences upon the vehicle. Common sense dictates that these cannot be permitted. Economy demands that the machines be operated with care and kept moving as much of the time as is practical. Whatever time is taken from the service time of the wagon or truck for loading, for delivering, for traffic delays, for adjustments or repairs upon the road is the loss of the owner, and the value of this time is seldom realized or understood.

The determination of the actual work performed depends practically upon the form of record made. Primarily it is not possible to have a definite load unit that can be generally applied, and the loads will vary widely. There are instances where the loads may be standardized, but these are not often met with. If one



The Case of the Servis Recorder Opened, Showing the Circular Chart on Which the Data Are Automatically Noted.

were to keep precise data of the loads this would necessitate more labor, and this is to be avoided when possible. In many cases loads will differ as to weight and

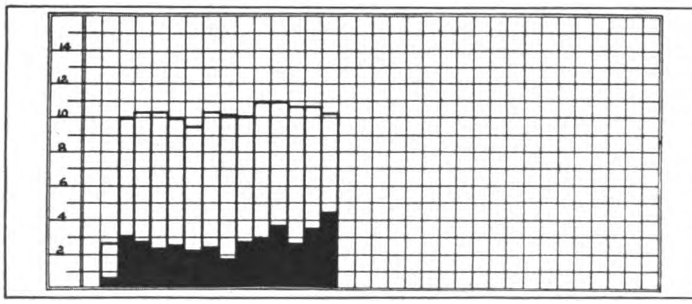


Fig. A—Graphic Chart Showing Two Weeks' Test of 10 Trucks in Heavy Haulage Service.

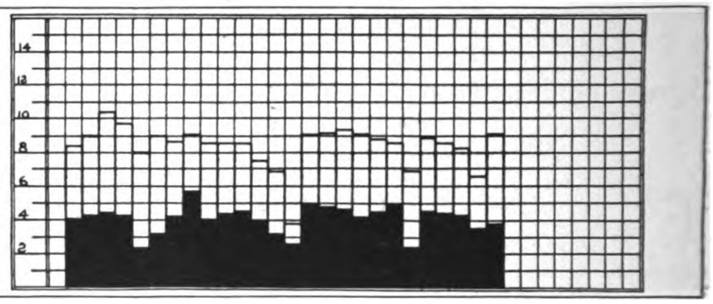


Fig. B—Record of Cleveland-Akron Bag Company's Equipment Fitted with Recording Instruments.

bulk and to average them does not afford the result sought. When freight is weighed and the mileage is known one basis accepted is tonnage and ton-miles, but where packages and goods of variable bulk and weight are carried, sometimes the cost of each is averaged. But where productive time is to be ascertained the assumption must be that the loads are normal—the capacity of the vehicle. Otherwise a smaller machine would be more economical. Surprising as it may appear, the general inclination is to overload motor wagons and trucks, which is destructive of mechanism and tires, and to disregard the time of productiveness. This is a more general fault than is almost believable, and instead of the economy that might be possible there is a loss that is seldom realized.

There are those who have accurate record with reference to administration, operation, care, maintenance and expense from every angle, who do not give the attention to the economy of productiveness that is desirable or necessary. The fact that this is neglected is because there is indifference as to methods or a continuance of work under conditions that existed with horse equipment. There can be no doubt that no manufacturer or business man generally would purchase improved machinery and continue manufacturing as before. He desires to realize the fullest benefits of his increased productiveness, and it was this prospect that impelled the change. This being so he adapts his methods to whatever the requirements may be. But this is not done with motor transportation equipment.

Those who have given careful attention to transportation efficiency understand that the working time may be of practically any length and the productive time, which is the real factor, but a very small part of this. There must necessarily be time for loading and unloading, but all stops or delays aside from these mean a sacrifice of useful work. How this can be best economized is a problem that can only be ascertained by careful study, and by comparisons of the working time and the actual working time. Figures do not always adequately represent these, because few can measure accurately by a measure they cannot readily picture, but by charting these by days it is practical to reduce the factors to a state where they can be clearly understood.

Of course it is necessary to obtain specific information, which cannot be done without a dependable instrument that will record the facts essential to such analysis, but when this has been secured the reduction can be made in whatever manner will best serve. Some extremely interesting facts have been developed by the Service Recorder Company, Cleveland, O., in studies of delivery work of different companies that use the instruments made by this concern, and these have been presented in chart form that the statements made can be the better understood. Without question the operation of the motor wagon or truck is not within the control of the manufacturer of the machine, though it is entirely practical for his representatives to observe the work and to make recommendation for service, but a very large proportion of owners, while they will agree that the principal object to be accomplished with motor equipment is to keep it moving, will not admit that their own service is in any way inefficient.

The man who makes his own comparisons from reports submitted does not always grasp the conditions as they really are, and some can only comprehend fully where losses are experienced when attention is directed specifically to some glaring fact. Perhaps this statement is best emphasized by the quotation of this paragraph from a letter received by the Service Recorder Company:

> We are glad to tell you for your information that we are now operating one five-ton ...., two 3.5-ton .... and one two-ton .... While these trucks are giving us

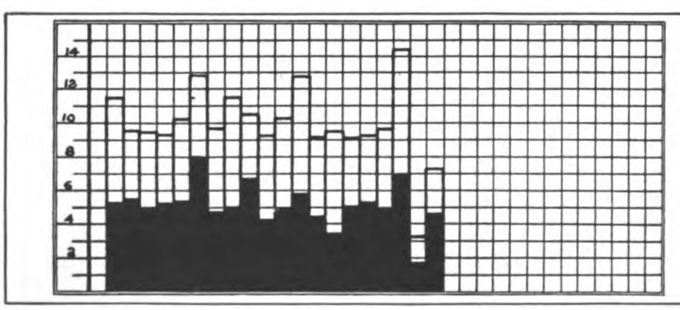


Fig. C—Chart of Halle Bros. Company, Cleveland, O., Showing Result of Superior Loading Facilities.

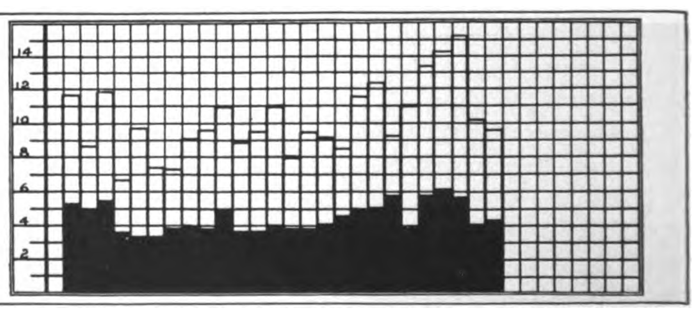


Fig. D—Work of May Company's Equipment, Cleveland, O., Reduced Service Resulting from Conditions of Doing Business.

very good service, we find the expense of the upkeep a great deal more than horses. We are perfectly willing to concede that a gasoline truck does more work than a team of horses, but we cannot yet figure out after our depreciation, insurance and wage charge are accounted for, whether we are going to come out as cheap at the end of the year as with horses. We can get all the teams we want for $6 a day and the trucks do not do all the work that two teams would and we cannot operate a truck for $12 a day. It may be due to the fact of our driver, etc., and that is what we are willing to spend a little money to determine.

The statement was made that the actual working time, not productive operation, was in this case not four hours a day, and a test for a week showed an average of two hours and 40 minutes, which was a sufficient explanation of the condition that had been stated by the owner. It is quite needless to state that this analysis resulted in a substantial improvement and decidedly greater efficiency. Assuming that the loading facilities are reasonably satisfactory and the delivery conditions such as are customarily met with, the statement is made that a machine should be moving 66 per cent. of the working hours, this giving the remaining 34 per cent. to loading, unloading and the delays that may be experienced from causes beyond the control of the driver or the owner.

In connection with this some decidedly interesting charts have been prepared by the Service Recorder work in the same city, so that the comparison may be regarded as being as fair as could be made.

Fig. C chart is plotted from the records of Halle Bros. Company, a well known department store of Cleveland, O., and its usefulness can best be understood by comparison with Fig. D, which is similarly plotted from the records of the May Company, which also conducts a department store in that city. The difference in service time may be credited to superior loading facilities and to a different class of dwellings and to the fact the packages are lighter and smaller as a rule. In Fig. D it may be noted that there is considerable variance in the actual working time, and the delivery made shows that the greatest volume of business is at the first and last of each month.

Fig. E shows the chart compiled from a month's work by the delivery equipment of a firm that is using seven trucks to do what could be done with five machines, and the first three weeks represent an average of 70.6 per cent. of the service time the machines were not working, and the highest daily tonnage was 69,000 pounds. The fourth week the percentage of working time was increased to 34 per cent., with an increase of the daily tonnage to an average of 89,000 pounds.

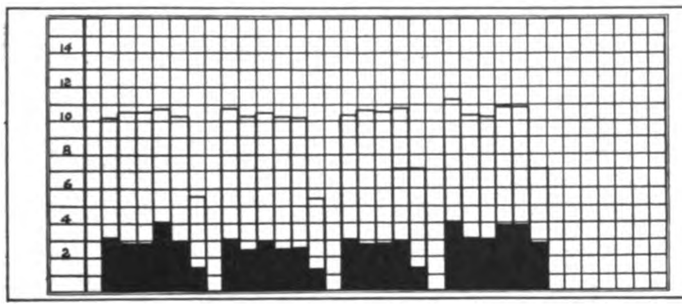


Fig. E—Showing 70 Per Cent. Idle Time for Three Weeks and Reduction to 66 Per Cent. by Improved Supervision.

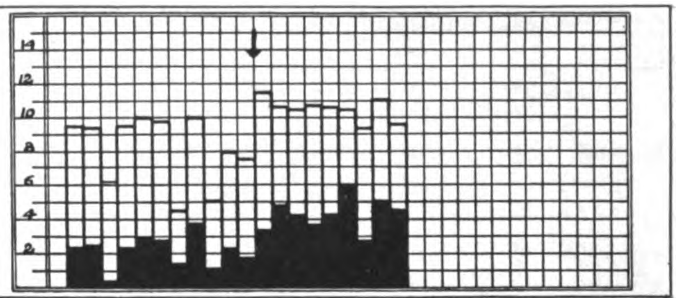


Fig. G—Chart Showing Work for Two Without Recorder Data—Arrow Indicates Improvement After Information Was Used.

Company which show the proportion of actual working time, not productive time, to the daily service of different haulage equipment. That shown at Fig. A represents a two weeks' test of the service of a concern that used 10 heavy duty gasoline trucks for inter-factory and delivery haulage. The slight improvement indicated in the last four days was caused by casual supervision of the shipping department. When this test was made the company was considering the purchase of several more machines, and the record showed that better administration and not more machines was needed. In reading these charts the vertical columns indicate days and the transverse columns indicate the hours of the day up to 16, and the figures shown at the left side indicate the hours in multiples of two.

It will be noted there is a considerable difference when comparison is made of Fig. A and Fig. B, the latter being a record of the service of the Cleveland-Akron Bag Company, which has its equipment fitted with recorders. Fig. B shows that the service time is less, but the actual working time, and consequently the productive time, is greater. The trucks are similar in size and make and are engaged in a similar class of

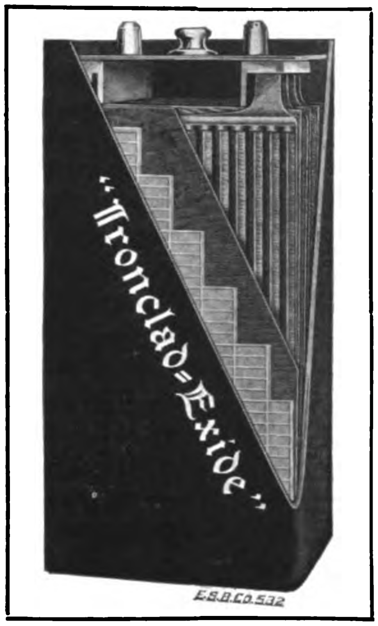
Fig. G is the charts of two weeks' work for a firm that was made with a recorder equipment, and the arrow indicates the day when the drivers and the shipping clerk were both notified of the need for improvement. When the full equipment was installed the percentage of working time fell below the results shown by the last half of the charted record, as there was not sufficient work to keep all of the machines busy, and the shipping clerk admitted that while the recorder was on but one truck the vehicle and the crew were worked to the extreme to make a showing.

The value of such records is demonstrated from the charts, for they afford a means of accurately measuring the proportions of the service time the vehicles are actually working, and by record of the loads carried the real productiveness of any vehicle or number of vehicles can be very accurately determined. Carrying the analysis further, it is practical for an advertising manager or merchandising manager to study the number and character of stops made in any given section of a city, and by study of that section to determine what best appeals to the residents, and whether a given section or a specific class of residents yields profitable business.

THE SIMPLICITY OF THE LEAD BATTERY.

By C. H. Bristol.

WITH the enormous increase in the use of electric trucks should naturally come a corresponding interest in storage batteries. "Electrics" in their proper fields of service have been proven to furnish the most efficient and economical form of transportation for city and suburban use. For various reasons, however, truck owners and prospects have not always given sufficient time and attention to properly investigate batteries, and to learn of the differences in the various types and of the simplicity in the care and operation of the lead battery, which is so universally used. The battery is a most important part of a car, since it furnishes the power for propulsion, and since the efficient and economical operation of the car depends largely on the battery.



Sectional View of "Ironclad-Exide" Cell.

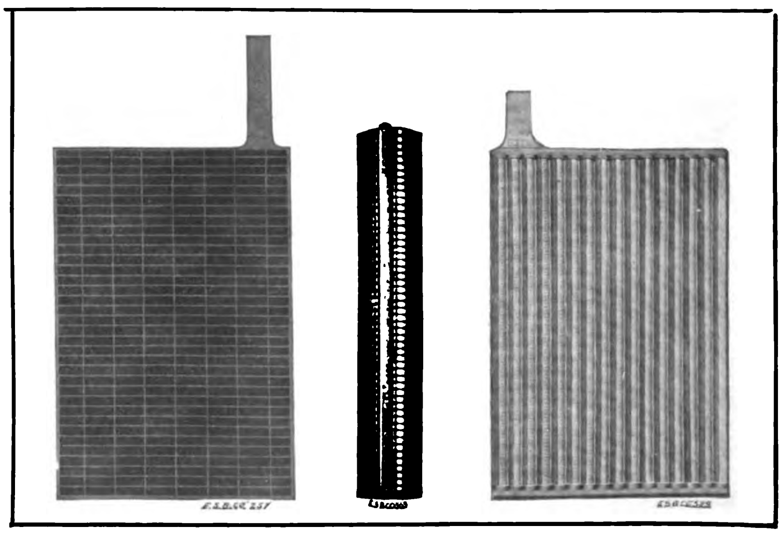
This reluctance on the part of merchants and manufacturers to give the battery proper consideration has been due, as stated, to a number of causes. First, perhaps, it has been due to the numerous stages of development through which the lead battery has passed to its present state of perfection; second, to the technical and uncommon terms usually used in describing it, and third, knowing that the battery was both a chemical and electrical proposition, they had inferred it was naturally complicated and without investigation have simply evinced no further interest.

It is true in the case of the lead battery, as in many other pieces of apparatus or articles which have gone through numerous stages of development and refinement, that the present lead battery is an entirely different proposition from the earlier batteries that were developed and in many cases marketed, and the failures of earlier types have been an obstacle which the present lead battery manufacturers had considerable difficulty in overcoming. The mere fact an electric vehicle is operated by a storage battery has been enough to frighten away some truck users.

However, in contrast, it has been interesting and instructive to note that many large concerns who have tested and used "electrics" have regularly added them for delivery or haulage service and these same concerns are now among the largest users of this type of vehicle. In all fields, including both light delivery and heavy haulage, "electrics" are being adopted in large numbers. Such a showing is perhaps the best evidence to the storage battery agnostic that the present lead battery is a practical and dependable source of power for propelling a vehicle.

It has, of course, taken years of work and experience to develop the present type of battery. The first type of storage battery was developed in 1860 by Plante, from whom one type received its name. The forming of the active material on this plate proved to be such a tedious and expensive process that it was only used for few purposes. In 1880 came a wonderful advance in the art when Faure brought out a plate in which the active material was placed in a lead blank in the form of paste. This improvement was looked upon then as the final answer in storage batteries, with the result that large quantities of these batteries were at once manufactured. This type of battery, however, also proved to be unsuited and it was its failure which gave the lead battery a set-back that took years to overcome.

In 1895, when electric vehicles first appeared, battery manufacturers turned their attention to the development of an electric vehicle battery. The well known "Exide" battery was then brought out. This battery has been improved from year to year, and having stood the test of time, is now used in thousands of "electrics". It was the successful result of an attempt to make a vehicle battery that would give sufficient capacity and at the same time long life—this accomplishment having been previously tried with all attempts resulting in failures. The early success of the "Exide" battery was due no doubt to the years of ex-



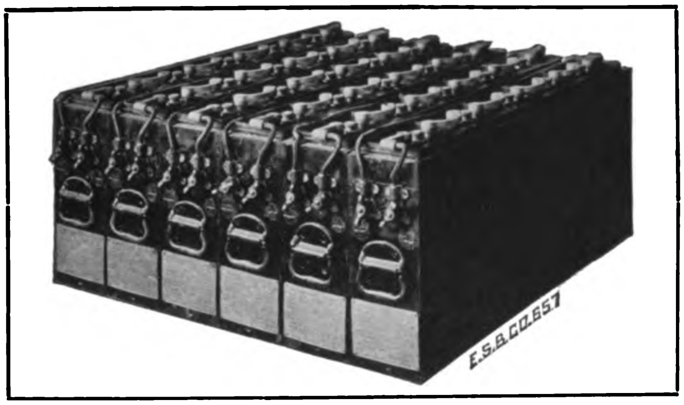
Electric Storage Battery Company's Construction: Exide Positive Plate; Horizontally Slotted Hard Rubber Tube of "Ironclad-Exide" Positive Plate; "Ironclad-Exide" Positive Plate.

perience that the manufacturer had in other fields of storage battery use.

For years this type of battery has made remarkable showings in electric vehicle service and the growth in the use of "electrics" was in no small measure due to its success. Modifications of this standard design, which has been used in a large percentage of all "electrics" manufactured, followed. The demand for greater mileage among some users was met in the "Hycap-Exide" battery and later when even longer distances must be covered by one charge of a battery, the "Thin-Exide" battery was developed.

During these years in which the pasted plate type of battery was showing such good results, there had been one feature of its design which showed promises of improvement. Vehicle users found that it was sometimes an annoyance to take a vehicle out of service for cleaning the battery, this being necessary, due to the fact that part of the plate material had been shed and had collected in the bottoms of the battery jars, where, if allowed to remain, it piled up, short circuited the plates and thus seriously affected the capacity.

This, the last and only objection that could possibly be raised against the lead battery, was completely solved in the "Ironclad-Exide" battery. This improved type of battery, instead of using for the positive plate a metal grid into which the active material is pasted, uses a series of hard rubber tubes containing the active material, which are horizontally slotted, allowing the free circulation of electrolyte. This new and latest type of battery has overcome the annoyance and expense previously experienced from taking a vehicle out of service for battery cleaning. The reliable day-in and day-out service from an electric truck, which is such a desirable feature, is now assured.



Thirty-Cell Type 13 MV "Hycap-Exide" Battery in Six Trays.

An interesting feature in connection with the development of the lead battery has been that at the same time the battery was being developed to give more capacity and longer life, it has also in turn been simplified so that it could be more easily operated and cared for. Referring again to the "Exide" battery, which has been chosen for illustration on account of its wide use and familiarity among vehicle users, it is found that the instruction book furnished to a vehicle user is a small envelope size pamphlet of but six pages. This in itself should instill confidence in the mind of an electric truck owner or prospect and at least prompt him in finding out what these few pages contain.

There are but few rules to be followed in connection with the use of a lead battery such as one of the four "Exide" batteries. Any man of ordinary intelligence who will give a battery a reasonable amount of attention can procure perfectly satisfactory service from it. There are, of course, exceptional occasions when conditions arise with which a man is not familiar, but at such times he can readily obtain advice or information of any kind by communicating with one of the sales offices or depots of the battery manufacturer, which are conveniently located in various cities about the country.

The operation and care of a lead battery is in no way complicated and with ordinary care will give excellent service. Good evidence of the simplicity in the care and operation of a lead battery is shown by the thousands of owners of electric pleasure cars—many of them being women—who take care of their own batteries and who had no knowledge of storage batteries until they purchased an electric car.

"FENDERIZING" MOTOR TRUCKS.

Chicago Owners of All Service Vehicles Have 90 Days to Comply with Ordinance.

Unless some of the city solons repent and suspend or extend the provisions of an ordinance recently enacted by the city council of Chicago, it will be necessary for the owners of all vehicles used for business purposes, aside from carrying passengers, within 90 days, to provide them with "a fender, as in the case of street cars operated and used within said city", such as may be approved by the board of inspectors of public vehicles.

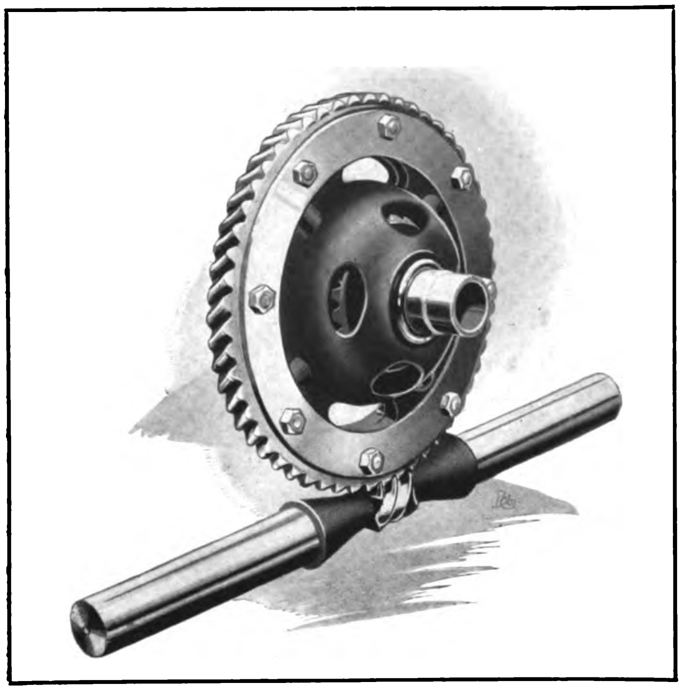
So far as known the only motor vehicle ever constructed that was equipped with a fender was that built for John Shepard, Jr., of Providence, in 1896, and this was for the purpose of exploiting the device as applicable to street cars rather than with any idea that it would be useful with motor carts and wagons. In this case the machine was more of express wagon construction than what is now regarded as conventional truck design, and the fender was permanently located.

To afford satisfactory protection a fender must be ahead of the wheels and be so low that it will lift an object, and to have the strength and permanency the construction must be well designed and be so adapted that it will not reduce the utility or efficiency of the machine. Just how the Chicago men are going to meet the problem is unknown, but there is no doubt that the ordinance, if it is not materially changed, will be a hardship for the owners of vehicles and will militate against the further use of power wagons and trucks in that city.

THE WARNER-LANCHESTER WORM DRIVE.

By Paul Davies.

DESPITE the great progress which has been made during recent years in every branch of engineering knowledge, there still remains a certain prejudice against the use of worm gearing. This is due to a variety of reasons. In the first place, there has always been a general impression that worm gears were inefficient compared with bevels or with chain drive, and even when this view was proved to be unfounded, those manufacturers who took up the supply of worm gears failed to secure the necessary accuracy of workmanship and high quality of materials which are essential for the securing of satisfactory results.



The Warner-Lanchester Worm Shaft, Gear and Differential.

In consequence of these facts, many car manufacturers who have experimented with worm gears have not obtained good results and have therefore reverted to the use of bevels, acting under the belief that satisfactory worm gears were unobtainable.

This is quite an erroneous idea, and we would impress upon the reader two main facts: That worm gearing of the type constructed by us is as efficient as the best of bevel gears, and that, so far as durability and freedom from trouble are concerned, these worm gears are absolutely satisfactory in every way and, indeed, superior to bevels, in that they run noiselessly without the need of adjustment.

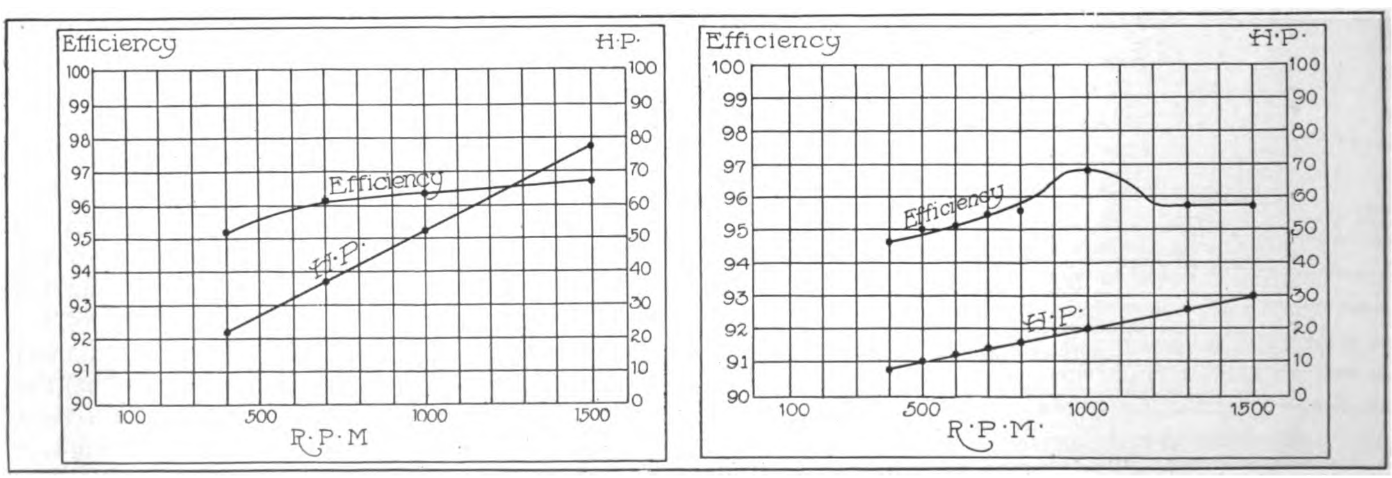
The advantage which worm gears offer in comparison with bevels are widely known, and it is hardly necessary to do more than recapitulate the chief points. What we have to emphasize most strongly is that on the one feature which has previously been regarded as debatable—the efficiency of transmission—there is no longer any room for doubt. As far as efficiency is concerned our worm gears are quite equal to the best bevels manufactured.

The Warner-Lanchester worm gear has much in common with the Hindley worm. That is to say, the worm and wheel are of a form mutually adapted to each other. The teeth are fully entered during the whole of their engagement and are entirely free from the tooth form difficulties of the ordinary parallel type of gear.

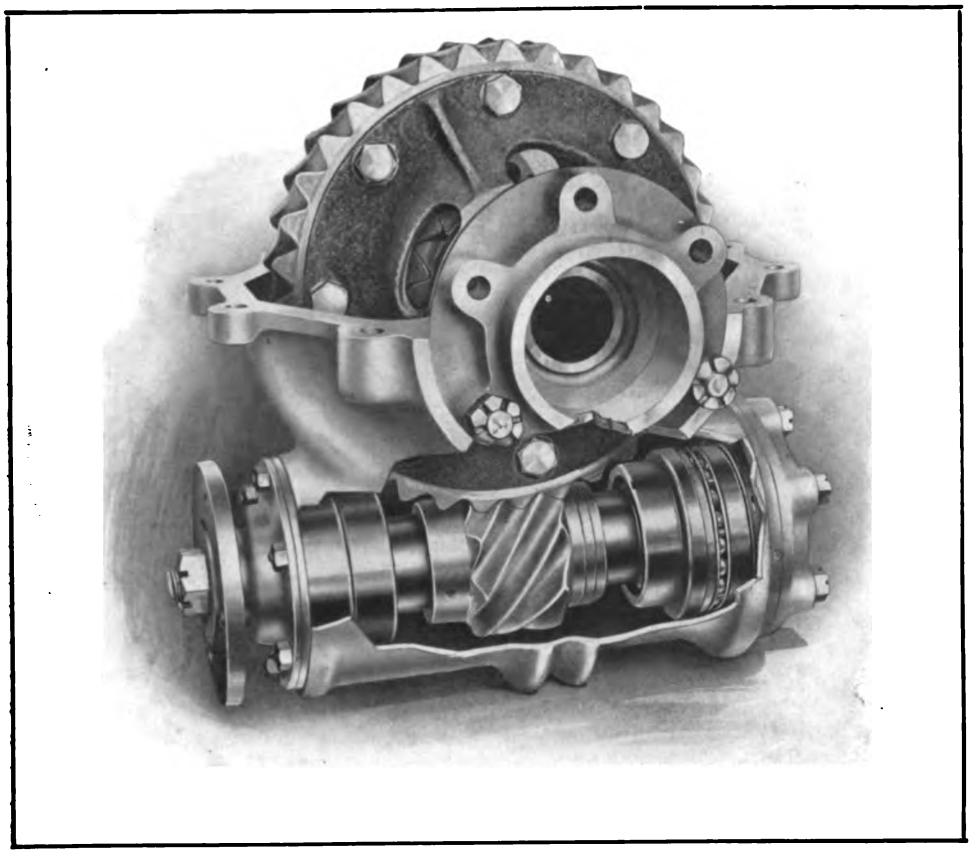
Silence and Strength.

Worm gearing provides a smooth and uniform means of power transmission. This contrasts favorably with the intermittent action which obtains in the case of bevel gears, and which is the cause of the humming noise characteristic of the bevel drive. But apart from the big difference in the actual nature of the impulse, it is important to note that in worm gears the load is distributed over several teeth—in the Warner-Lanchester worms there are always three teeth sharing the load at once.

In bevel gears, however, there is only one tooth actually transmitting power at any particular instant; the other teeth just coming into or leaving contact hardly bear any appreciable share of the load. Hence it will be realized that worm gears are much stronger



Efficiency of Worm Gearing: At Left, 9-34 B. L. H.; at Right, 8-35 B. L. H.—Plotted from Tests Made by the National Physical Laboratory of England.



Phantom View of the Warner-Lanchester Worm Shaft and Gear.

in every way than bevels and that they can be subjected to a considerable overload without risk of failure.

Another important fact is that the wear which takes place on the worm teeth in course of time does not affect the efficiency or silence of running of the gears in any way. On the other hand, worn bevels are invariably noisy and are, in addition, much less efficient than newly-cut gears.

Bevel gears have but a limited range as far as gear ratio is concerned, but with worm gears there is no difficulty in obtaining as big a reduction as is ever likely to be required. This is an important fact in the case of commercial vehicle work; here, the use of a single pair of worm gears replaces the double set of bevel and spur gears necessary when a big reduction is required.

Even more important is the thoroughness of the lubrication obtained with the hollow worm gears. By reason of the fact that the area of pressure moves right across the face of the tooth, there is a constant passage of oil to the regions of highest pressure. The value of this fact cannot be over-estimated; it at once places the Warner-Lanchester worm gears on a level far above the ordinary type of gearing.

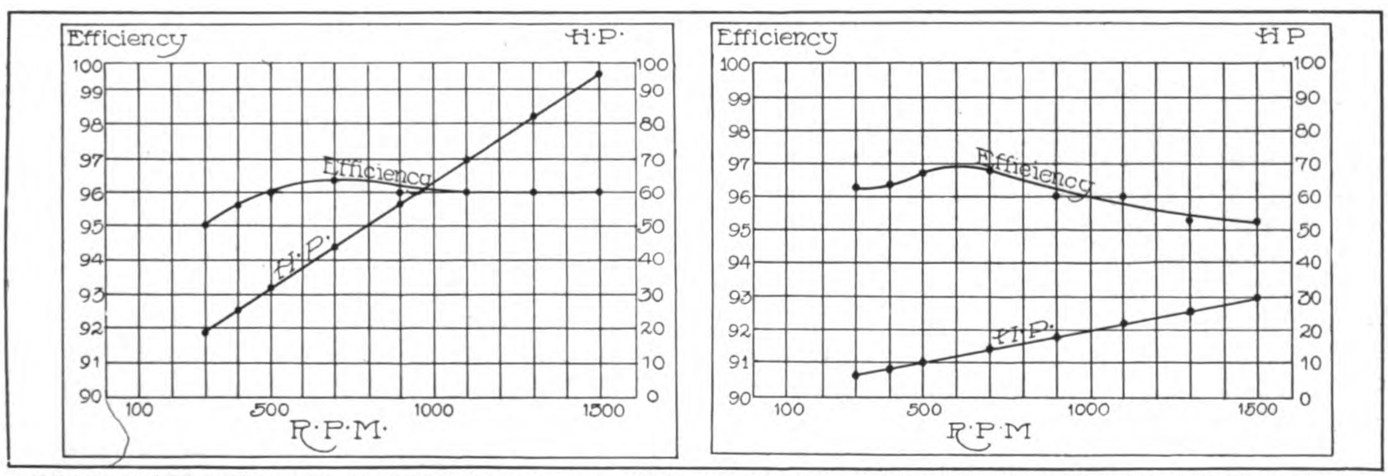
Efficiency.

Recent investigations have shown that the efficiency of the Warner-Lanchester worm gear under ordinary conditions of usage (that is to say, at worm speeds ranging from 500 revolutions upwards) is over 95 per cent., and efficiencies of 97 per cent. and above have been recorded.

The measurement of high efficiencies such as these presents difficulties of a serious kind, and the usual method of measuring power input and output separately cannot be relied upon, the errors of the experiment being far too serious.

The new Daimler testing machine (the invention of F. W. Lanchester, patent applied for,) has been designed to give a direct measurement of efficiency and successfully performs this with an error of probably less than one-tenth of one per cent. The new testing machine insures certain special refinements both as to finish and lubricant. The advantages of these separate improvements could not have been detected by previous methods, but their accumulated effect is of most marked value.

The actual results of careful tests are shown in the following figures, which call for no explanation. It will be observed that the efficiency is quite high, even



Efficiency of Worm Gearing: At Left, 10-31 B. L. H.; at Right, 8-33 B. L. H.—Plotted from Tests Made by the New Lanchester Machine at the Daimler Company's Works.

at low speeds—this is the point which we desire to emphasize.

Overload Capacity.

One of the most important features of the Warner-Lanchester worm gears is their ability to withstand excessive loads without damage. This overload capacity is a very great advantage in view of the heavy driving and braking stresses which can be imposed on the transmission gearing by a careless driver. With bevel gears there is always the danger of stripped teeth, but such an occurrence is an impossibility if worm gearing is employed.

As with every other form of gearing, proper lubrication is an essential condition for obtaining satisfactory results with worm gears. Under normal conditions of running, our worm gears will outlast bevels of similar service, with this important difference, that the worm gears will always run as silently as they did at first, whereas with bevels a certain amount of adjustment is necessary when wear has taken place.

Position of Worm.

The standard position of the worm is below the axle; lengthy experience has proved that this is the best method of ensuring adequate and constant lubrication—especially at low speeds. The Warner Gear Company recommends the worm beneath the worm wheel, and this practise has been adopted by almost all car manufacturers who employ the silent drive. However, when special conditions, such as the necessity for maximum ground clearance, render it advisable to place the worm on top, this may be done, provided that precautions are taken to ensure a copious supply of oil at all times.

DISCUSS PARCEL DELIVERY.

Motor Truck Club of New York Listens to Department Store Shipping Heads.

The September meeting of the Motor Truck Club of New York was given over to the consideration of parcel delivery by motor truck, and the subject was discussed by club members and some of the heads of the shipping departments of New York department stores. The club membership is composed of men active in the industry and trade, as well as those connected with industrial and commercial enterprises, and the discussions are intended to bring about exchange of ideas and experience for the general benefit of all.

Among those who addressed the club were H. M. Martin, president of the H. C. & A. I. Piercy Contracting Company, general transportation contractor; Louis Crispin, superintendent of transportation for John Wanamaker; C. R. Langenbacher, superintendent of delivery for Lord & Taylor; George Stevens, transportation engineer for the Adams Express Company, and George H. Bailey, delivery manager for the Riker-Hegeman Corporation, each explaining the systems the vogue of which they were in charge, and stating conditions and problems that were met with in organizing the work. The opportunity of learning first hand of the character of work performed, the facilities, the systems, the forms of administration, the territory covered, and the results accomplished, which information could not be otherwise obtained save at material expense and time, developed surprising interest and decided benefits. The purpose of the club is to continue these educational gatherings monthly.

EDUCATING THE COMMUNITY.

Worcester Electric Light Company Disseminating Information Promotive of Electric Vehicle Use.

The example of John E. Smith, who has charge of the electric vehicle department of the Worcester, Mass., Electric Light Company, is worthy of the reflection of those who have to do with the promotion of the use of electric vehicles. He has sought to educate the business men of the territory served by his company by the publication of statements of the practicality of the machines and the uses that can be made of them. This publicity is necessarily in generalities, for it is prepared for wholesale consumption, but Mr. Smith maintains that it is beneficial and that it attracts the attention of those who might have casual interest were not the economy of the electric machines emphasized, and the assurance of the co-operation of the company impressed upon them.

During the California state fair, that took place at Sacramento beginning Sept. 12, there was an exhibition of service wagons of all kinds, and demonstrations of capacity, etc., by the exhibitors. A considerable number of the exhibits were driven from San Francisco over the road, leaving that city together, and showing the people the practical possibilities of the machines by using them under normal service conditions. The distance between the two cities is approximately 100 miles and a stop was made at Oakland, where a night was passed. At the fair the machines were displayed in a large tent and 10 different concerns showed 15 makes of vehicles, including delivery wagons, trucks and tractors. Two of the exhibits were electric machines.

The principal business of the monthly meeting of the New York Section of the Electric Vehicle Association of America, held at the Edison auditorium, 44 West 27th street, in that city, Sept. 23, was hearing and discussing a paper on "The Value of Power Wagon Operation in the Community," read by F. J. Ryan.

The National Transportation Company has been formed at Bloomfield, N. J., for the purpose of operating a motor omnibus line between Paterson and Montclair, to afford a public service to the state normal school. The company has contracted for two vehicles that will carry 35 passengers each.

U-S-L MAINTENANCE SERVICE.

The U-S-L Service Station and Electric Garage at Buffalo, N. Y.

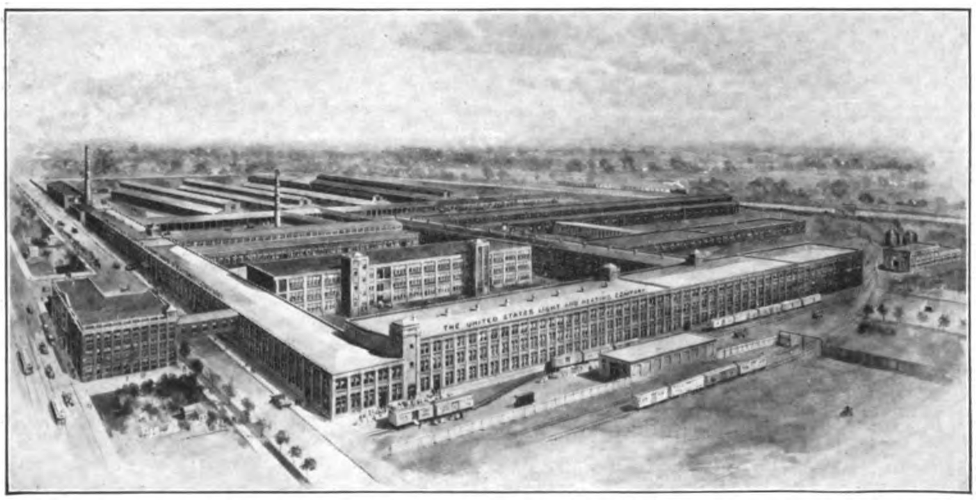
THAT branch of the U-S-L organization termed the service department, which the United States Light and Heating Company, manufacturer of the U-S-L guaranteed storage battery, has built up for the specific purpose of extending service co-operation to users of U-S-L products, is international in the scope of its operations, reaching every nook and corner of the United States and also all foreign countries where the U-S-L trade mark is found.

In the early days of electric vehicle transportation there was a scarcity of men who thoroughly understood the proper care of storage batteries and who were capable of conducting an electric garage so as to obtain the greatest number of years of continuously good battery service. This condition was only natural. It could hardly be otherwise in the inception of such an industry and the United States Light & Heating Company early recognized the great value to both itself and customers of a service department devoted entirely to instruction in the proper care of storage batteries and to keeping in touch with the every-day performance of the batteries to insure to owners that they obtain the best and most economical results.

The U-S-L service department has grown with the electric vehicle industry and now has headquarters in the United States in eight large cities: Boston, New York, Buffalo, Cleveland, Detroit, Chicago, St. Louis and San Francisco. At each U-S-L service station there is a corps of service men constantly employed in travelling through the territory which that particular service station covers, giving assistance wherever needed to U-S-L battery owners. These men are not only battery experts, but are also thoroughly familiar with the mechanism, care and operation of electric vehicles, both pleasure and commercial types. In fact, before a man can qualify for the U-S-L service department he must have a complete practical understanding of batteries and electric vehicles so that he will be able to extend the kind of service co-operation that really helps.

All U-S-L service men are graduates of the U-S-L training school, which is in session the year around at the U-S-L factory. Here the men are taken in hand by engineers and given a full course in the methods of battery manufacture from the first operation on the raw materials to the final assembling and testing. They are instructed in the care and operation of batteries and electrics and are required to do practical work in every department. Once in the field each factory graduate spends a certain amount of time under the tutelage of one of the regular service men. After this training he is competent to give U-S-L battery owners the best kind of service co-operation.

At seven of the eight U-S-L service stations depots are maintained for the purpose of assembling and repairing batteries and of keeping a complete stock of spare parts on hand for quick delivery. This does away with the delay that would occur if all assembling and repairing were done at the factory, and if the factory were the only place where spare parts could be obtained. Each depot is equipped with all the apparatus necessary for the complete assembling, repairing and testing of batteries, and because of the fact that the stock of spare parts is always complete all work is accomplished with dispatch. A great deal of



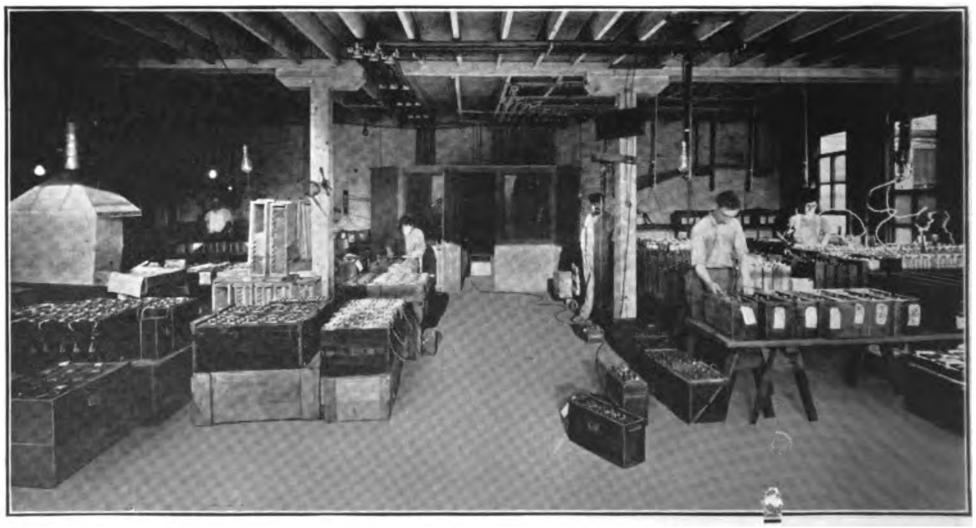
The U-S-L Plant at Niagara Falls, N. Y., Claimed to Be the Largest Storage Battery Factory in the World.

The U-S-L Branch Office at Cleveland, O.

attention has been given by the United States Light & Heating Company to the depot feature of the U-S-L service department because, especially in the case of electric delivery wagons, it is often essential that repairs be made in the shortest possible time.

The kind of service that the United States Light & Heating Company is prepared to give is especially valuable, for example, to anyone who is changing to the electric vehicle method of delivery. In such a case, if assistance is needed, a U-S-L service man gets on the ground early so as to insure that the batteries are handled properly, beginning with the first day. He keeps closely in touch with the performance of the vehicles until the garage men in actual charge understand thoroughly every point involved in the proper care of the batteries, and he is therefore ready at any time to render such aid as may be necessary. The work of the service men is supplemented by instruction books which the company sends out with all shipments of its battery equipment.

U-S-L service is available to every U-S-L customer whether he operates an electric pleasure car, one truck, or a fleet of trucks. In building up its service department the United States Light & Heating Company has endeavored to make it all that the name implies—large enough to reach all those who require assistance and capable of rendering such assistance in the most beneficial manner. Service co-operation is only of value when intelligently given and to this end the U-S-L service department has been developed.



The Interior of the U-S-L Service Station at Cleveland, O.

TARIFF TAX REDUCED.

Duty on Chassis and Finished Parts Now 30 Per Cent Instead of 45.

The new tariff law, which is now effective, places the import tax on chassis and finished parts of motor vehicles at 30 per cent. instead of the 45 per cent. tax imposed by the old schedule, and this is expected by dealers and agents of the manufacturers of machines made abroad to be of material advantage to them, as it will make possible the importation of service wagons and trucks for sale at a materially decreased price. There is no change in the tax on complete automobiles valued at more than $2000, this remaining at 45 per cent.

As the foreign machines are generally sold abroad without body equipment, it is expected that, to take advantage of the reduction in tariff, importations will be generally of the unfinished vehicles, the importers leaving to the purchasers the option of having bodies built to meet desires. So far as service wagons and trucks are concerned, however, there is no particular demand for imported bodies, and most buyers would prefer to have equipment built to specification or for special purposes. The importers of foreign machines believe that they will have a widely increased market because of the change in the tariff, and they maintain that because of the decrease in the tax there will be no discrimination made by other governments with reference to the sale of American machines in foreign markets.

The competition of motor vehicle manufacturers and agents was illustrated when the board of revenue of Jefferson county, Ala., meeting at Birmingham, gave hearing to nine different representatives who responded to an invitation to submit bids for a five-ton truck to be used in road construction. The "sellers" were so numerous that they were limited to 10 minutes each to make a "convincing argument."

SOLID TIRES FOR ELECTRIC TRUCKS.

The Essential Qualities Sought in Designing and Constructing Tire Equipment for All Methods of Vehicle Propulsion--How Efficiency Tests are Made.

By A. H. Leavitt, M. E.

IN GAS truck practise little is required of the solid truck tire except it be of sufficient resilience to insure protection to the truck mechanism, of positive application to insure permanence, and of a quality to give maximum mileage service. The solid tire for electric truck service, however, presents a different problem to the manufacturer, as not only resilience and permanent application are required, but in addition the compound must be such as to reduce the current consumption to the minimum, at the same time increasing the speed of the truck to the maximum.

The Problem of the Tire Manufacturers.

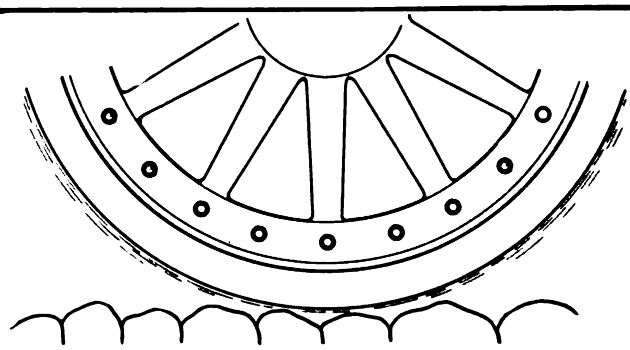
To the uninitiated this problem may appear of little consequence and the general impression of the efficient solid tire is one composed of either a very hard or very soft compound. The highest current efficiency is obtainable by equipping a truck with steel wheels and operating it upon a steel track; however, a rubber tire of excessively hard compound has been found to be efficient only under ideal road conditions such as asphalt or good hard macadam surfaces. On brick, cobble stones or rough roads generally, the vibration is extremely detrimental to the truck mechanism and the efficiency falls below that of a more resilient tire due to the slip of the wheels during the period of vibration. On the other hand, a tire built from an excessively soft compound presents such a large area of contact with the road when under load that there is a holding back or "drag", which materially reduces the speed and increases the ampere draw.

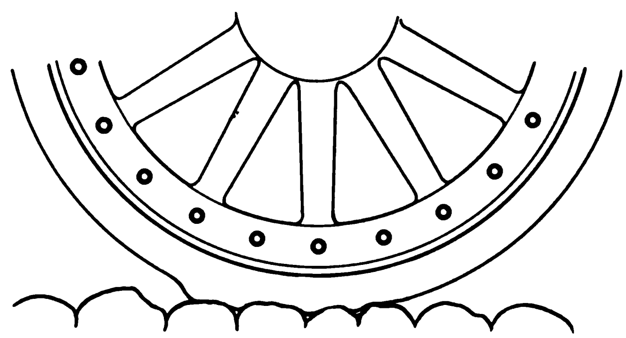
Knowing that too hard or too soft a tire will not be of the proper efficiency to meet the requirements for electric truck service, the tire manufacturer must develop a compound between these extremes, combining high current efficiency and speed. To determine the most efficient solid tire it must be taken from the laboratory and the final development made by numerous different tests, comparing various compounds and shapes.

The Road Test.

Manufacturers of electric trucks have established methods of testing solid truck tires for efficiency and while few use the same test upon which their decision is based, a majority use what is termed the road test. In this test a chassis is loaded to normal capacity by means of accurate weights and driven over a measured course at a constant speed. The records kept in such a test consist of the time consumed in covering the course, volts, amperes, atmospheric temperature, wind velocity and direction, and road conditions. In some cases ampere-hour meters are used to show the total current consumed, but as a general rule fully charged batteries are used in each individual test and total watts or ampere draw used as a basis for comparison. The tires showing the greatest efficiency are those covering the course at the greatest speed and with the lowest ampere draw or watt-hour reading.

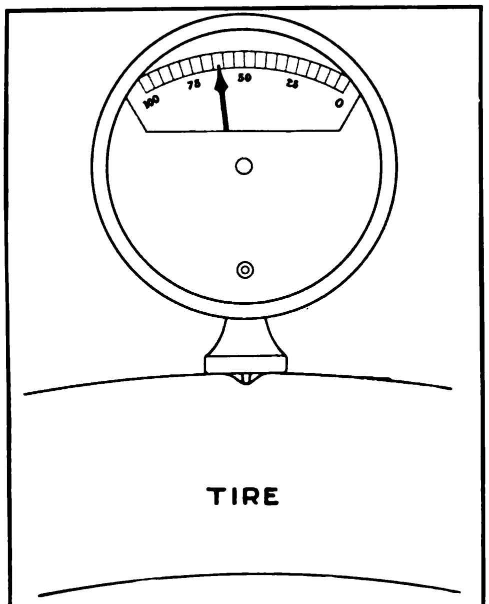
There are many chances for inaccuracies in making this test, and unless tires of differing types and makes are tested under identical conditions a fair comparison cannot be established. For example, it will be observed that an accurate comparison cannot be made if two sets of tires are applied to different chassis, even though they are of the same weight and capacity. The friction and other losses of the moving parts, as well as the efficiency of motor and batteries, might vary so


VIBRATION EFFECT ON HARD COMPOUND


"DRAG" OF SOFT COMPOUND

widely as to cause an apparent increase in power consumption not attributable to the tires.

Differences in the atmospheric conditions during separate tests will be reflected in the final results, hence accurate comparisons may be expected only where practically identical weather conditions prevail. Since atmospheric conditions also affect road conditions, the same set of tires would not show the same results if tested on a dry course as over the same route after being wet. Temperature also plays an important part in affecting road conditions, as can best be illustrated in the case of asphalt. On a hot day the asphalt would soften, causing the tire to stick or drag and con-



YIELD GAUGE

sume a greater amount of current than on a cold day when the asphalt would harden perceptibly, making a much faster course.

Wind resistance should also be constant in making comparisons, for it is obvious that more current will be required in running into a 20 mile an hour wind than one whose velocity is 10 or even 15 miles an hour.

The course over which road tests are run is usually either asphalt or good brick, and the final results show current efficiency and speed over but one type of road construction. In actual service the average electric truck meets all varieties of road and street construction and as the solid tire, most efficient on good hard asphalt, may show decreased efficiency over brick or cobble stones, and vice versa, the most satisfactory course is one including the greatest variety of paving. In this case an accurate average performance may be obtained. While the road test is theoretically the most accurate in determining the tire or tires with highest current efficiency, in order that dependable results may be obtained, the foregoing conditions must be as nearly alike as possible and the testing course should be a fair average of actual street conditions in service.

Grade Test.

The grade test consists simply of noting the length of time elapsing from the instant the brakes are released on a truck standing on a 20 per cent. grade, to the instant of passing the end of the grade. In this test time only is figured, for no current is required, and as the grade is usually artificial not much dependance can be placed upon the results. Should the same complete chassis be used in testing various makes of tires the results would be fairly reliable for comparison only, but the conditions under which the test is made are theoretically too perfect for drawing accurate conclusions with respect to results in actual service.

Coasting Test.

This test is very similar to the grade test except that distance is the basis of comparison rather than speed. In making the coasting test the truck is run at highest speed up to a marked point, at which the down grade begins. Here the power is cut off and the truck allowed to coast until coming to a standstill. Many of the variable factors are encountered in this test, as outlined in the road test, but in the main, the results are fairly accurate for comparison.

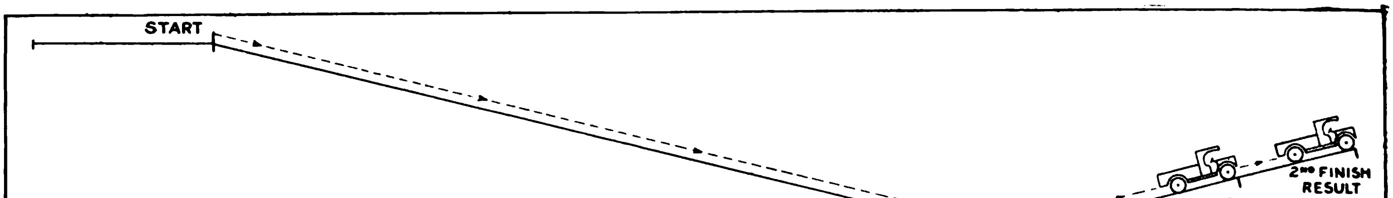
Impression Test.

This is a minor test used by one or two manufacturers and the results obtained are inadequate and unconvincing in comparing the efficiency of solid tires. The test is conducted by jacking a wheel from the floor, chalking the surface of the tire and removing the jack, allowing the weight of the wheel to rest upon a piece of cardboard or heavy paper. Upon removing the cardboard an impression of the length and width of the arc of contact is obtained. By comparing these arcs for various tires the results are supposed to show the comparative hardness. However, even these results are inaccurate for different shapes, and the test can best be used as a check for uniformity in tires of the same make and shape. Efficiency in current consumption and speed cannot be determined by this test.

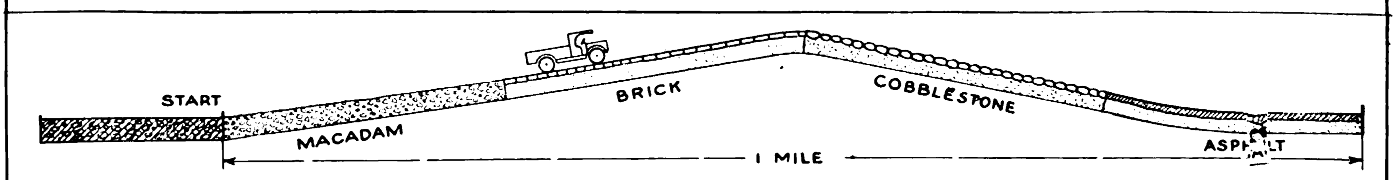
The Scleroscope.

The scleroscope, an instrument primarily designed for testing the hardness of metals, is sometimes used to compare solid tires for efficiency. This instrument has been accepted as a standard by different authorities for testing hardness of steel, and while a trifle intricate in its make up, consists mainly of a glass tube, graduated to scale, through which a weight is dropped and the rebound observed on the scale.

The results from this instrument are obtained by dropping a weight upon the tire and noting the rebound, the more resilient tires showing the greater re-



THE COASTING TEST

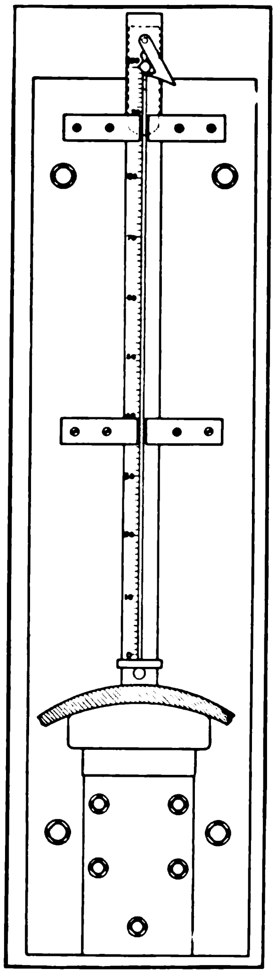


PRACTICAL ROAD TEST

bound. This test is not accurate for tires or rubber compounds, unless test pieces of the same dimensions are used. The difference in the shapes of tires, as well as the possibility that the tube may not be perfectly vertical for all tests, allows a great chance for inaccuracies. Again, the testing conditions are more nearly ideal than those encountered in actual tire service.

The Yield Gauge.

Practically everyone is familiar with the common practise of testing the resilience of rubber by biting specimens with the teeth or pressing with the fingers. Since these are very unsatisfactory methods, an instrument known as the yield gauge has been produced to take the place of the uncertain element of "feeling". By pressing the blunt end of the gauge against the tire to be tested, the amount of resistance to the pressure of a standard spring balance is shown on a graduated scale.



Modified Form of Scleroscope.

This test results in only a determination of the hardness of various tires, hence is not reliable for tire efficiency in point of current consumption, but is a fairly accurate check for compounds found to be up to requirements in this regard.

Conclusions.

From the foregoing it is apparent that the electric truck manufacturer should not base his decision for tire equipment upon any one single test, but should, so far as possible, make a careful comparison of results obtained from several. Far too frequently truck manufacturers are willing to sacrifice increased tire mileage in favor of reduction in weight. Tire manufacturers from long experience have established standard carrying capacities for all tire sizes, and the strict adherence to this standard is one of great importance in securing satisfactory tire service.

From the point of view of the truck owner, the problem is one of obtaining a tire which will reduce his cost a battery charge to the minimum, and at the same time increase his ultimate tire mileage to the maximum. Primarily the operator wants low current consumption, but it is also advisable to bear in mind the high cost of frequent tire renewals, involving also a considerable loss of time. Unfortunately, the truck operator has neither the time nor facilities for conducting the tests described above, but in view of the fact that practically all users are maintaining accurate daily records, any losses in speed or mileage a battery charge are promptly noted. When such losses occur an investigation of the tire equipment may disclose the weakness, especially if motor, batteries and transmission test up to standard.

WANT BOSTON SHOW SANCTION.

Electric Vehicle Men Protest Against Action of Governing Organization.

The annual meeting of the New England Section, Electric Vehicle Association of America, was held at Boston the evening of Sept. 25, at which time the following officers were elected: Chairman, J. E. Hunnewell, of the Lowell Electric Light Corporation; vice chairman, E. S. Mansfield, of the Edison Electric Illuminating Company of Boston; secretary-treasurer, Leavitt L. Edgar, of the Edison Electric Illuminating Company; executive committee, Day Baker, Fred M. Kimball, Frank N. Phelps, Howard T. Sands of Malden, Frank J. Stone, H. F. Thomson, Albert Weatherby, C. A. White and Paul E. Whiting.

The section adopted resolutions protesting against the refusal of the Motor & Accessory Manufacturers to sanction the exhibits that might be made by members at the annual Boston automobile and motor truck shows, and the executive committee was instructed to formulate the resolutions and forward them to the governing association.

A committee consisting of Day Baker, J. C. Codman and Business Secretary O. G. Draper was appointed to arrange for the attendance of the New England delegates to the annual convention of the Electric Vehicle Association of America, which will take place at Chicago, Oct. 27-28, and Mr. Draper was appointed master of transportation. James Fortescue, of the Massachusetts State Automobile Association, urged the section to make provision to oppose prejudicial legislation that would be proposed at the next session of the Massachusetts legislature, and maintained that it would be possible by properly directed influence to defeat, at the state election in November, some candidates who were known to be antagonistic to reasonable laws. The executive committee of the organization has charge of the campaign that will be conducted against the candidates and the measures that may be proposed.

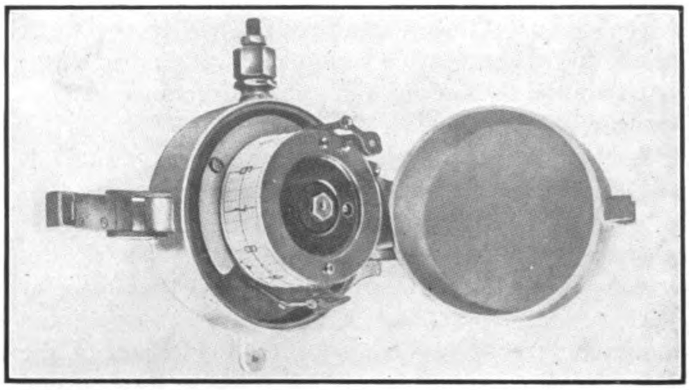
The Brockway Motor Truck Company, Cortland, N. Y., has issued a well designed booklet in which are illustrated the uses of Brockway air-cooled delivery wagons by 28 different concerns engaged in 24 lines of business, for all of which this particular type of machine is adapted.

The Coleman Gas Producer Company, New York City, will ship a motor car fitted with a Coleman gas producer to England, Oct. 15, which will be entered in the fuel competition of the Society of Motor Manufacturers & Traders, in which large prizes are offered for practical and economical operation.

VALUE OF VEHICLE HAULAGE DATA.

IN THE operation of any system of transportation there are factors that may be met with in all others, and there are others that may be peculiar to any given example, and with these variables to be considered in any analysis one must necessarily place some value upon these factors that specific and accurate knowledge may be obtained. One of the greatest difficulties experienced in the collection of haulage data has been the absence of a definite unit by which measurement may be made. In many instances endeavor has been to establish monetary value, either cents or dollars, as this standard, while others have sought to make comparison by work accomplished. But these are not sufficient because these factors vary materially.

The solution of the problem appears to be in adapting a definite standard to any business and then by comparisons with this standard ascertain whether or not the relative expense is greater or smaller. To illustrate: It is obviously valueless to regard wages as



The Recordograf with the Case Open, Exposing the Roll of Tape op Which the Record of Vehicle Movement Is Made.

a constant in any compilation when these will vary in some instances as much as 100 per cent., and, similarly, fuel expense cannot be established when not only the cost, but the character of the driving, the form of the motor, the topography, the street conditions and the loads carried all must be regarded as having material bearing upon this particular item of expense. One may go through every detail of expenditure for operation and maintenance and find that each may differ essentially.

Obviously the only certain determination can be made by first having all necessary facts with reference to one service and then making comparison—comparing the items, if there be desire to economize in this service, and the total, or, if there be a changed method of transportation, in the aggregate expense. To obtain such knowledge, however, it is necessary to have records that are standard and dependable. But in the absence of data that will permit of such comparison the only manner of obtaining precise knowledge is by adopting a system of records and then studying the work and the expense with a view to making such changes in the administration that will eliminate or reduce such costs as can be dispensed with and without impairing the efficiency of the service.

If one is to take up a problem of this character and would reach a solution that will economize in every detail one must begin with the administration and determine the expense that will include all fixed charges, such as interest on investment, depreciation, rent, heat, light, water, taxes, insurance, salaries, clerical work, printing, including real estate if a garage is owned and regarding the possible appreciation of property; the wages, fuel, lubricant, supplies, repairs, maintenance and upkeep, and with these as a measure determine if there be increase or decrease with reference to any one or all. Analyzing the cause of any variation in these items it is practical to ascertain whether or not there is economy or extravagance with reference to any or all, and to bring about such changes as will be economical.

But all this may be regarded as applicable to administration only. Yet this is not sufficient. What must be determined is the work actually performed by each delivery or haulage unit, which is only possible through following other factors, such as the loading methods, the facilities for handling freights, the conditions of making delivery, the system of routing, the manner in which the vehicles are operated, and the human element. No one form of record will show all of the facts that have been specified, and these must be divided so that they can be compiled and maintained with the least labor and expense.

Aside from administration and fixed charges, which may be applied pro rata or otherwise, the other factors are variables so far as expense is concerned, but the work performed is dependent upon conditions that must be definitely known, and which cannot be represented by office records so definitely as to be of value to others than the owner or those in charge of the transportation.

Considering the matter of handling freight and loading facilities as two conditions that must necessarily be known, and taking up the routing, the delivery, the operation of the machines and the human element, it is possible to ascertain very closely facts that have important bearing on efficiency. The record of mileage, for instance, will show distance driven and this will be of value in determining tire wear and fuel and lubricant consumption, and it is a necessary factor. It will also show the character of the routing if the hauls be anything else than straightaway and return trips. Under ordinary circumstances it is probable that the useful or productive mileage will be less than 50 per cent. of the distance travelled, for the average load is seldom carried more than half the time the vehicle is moving. In some work a load is carried the entire trip, but these instances are decidedly the exception.

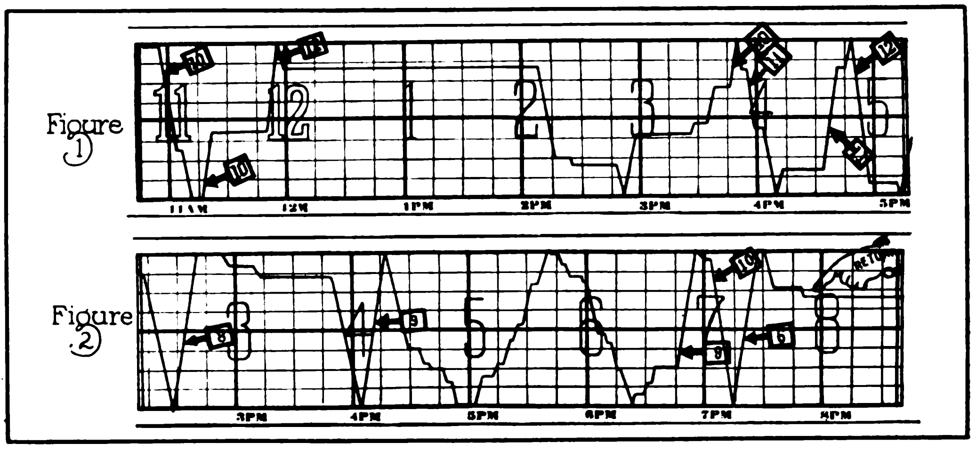
But when the vehicle has left the point of loading the manner of driving, the speed, the time taken for deliveries and the losses of time are factors of prime

importance, and these can be determined with exactness, so that the efficiency of the driver can be established beyond question. It was the necessity of affording such a record that caused the development of the Recordograf, an instrument invented by Edward A. Henkle of Philadelphia, Penn., and produced by the Delivery Supervision Company, that can be adapted to any vehicle. This device is contained in a circular metal case and is operated by a flexible shaft from one of the forward wheels, which records on a paper tape the time of starting a trip, the time of the return, the distance driven during the day and during any stated period, every stop made and the time of each stop, as well as its duration, and the various speeds during the entire time the vehicle is moving.

The record may be for a very brief interval or it may include the entire 24 hours of the day, and this will represent every fact that is desirable in establishing the use made of a machine. The record, like every other, has its chief value when it is analyzed and the work represented by it is known. That is, unless it is examined and the relation of every detail is known its value is not realized. It shows the work of the driver with regard to efficiency and safeguards the employer against imposition.

The instrument contains a roll of paper tape that is ruled longitudinally and transversely to form tiny squares, and each space between the longitudinal lines represents quarter miles, there being two miles to the width of the tape. The miles are differentiated by a heavier central lines. The spaces between the transverse lines represent quarter hours, the hours being represented by heavier transverse lines, so that each section of tape between the heavy lines is a mile in distance and an hour in time. A clock actuates a pointer or indicator transversely forward and backward across the paper tape and an indelible line is made that is at varying angles with reference to the ruled squares, or a line may be made which will run longitudinally of the tape.

The clock moves at a given speed and the tape is touched by the indicator. If the vehicle is standing the line is longitudinal, but if moving the line will be diagonal with reference to the ruled lines. Starting at any position the indicator will register on the tape, and the movement is shown by the transverse lines, so that the length of these lines shows distance driven, while the time is indicated by the heavier transverse lines. To the better illustrate: If the vehicle were driven 10 miles an hour, for instance, and at a constant speed, the line would be five times across the tape; if 20 miles, 10 times across the tape; and the angularity of the line indicates the speed. The variations of angularity show the changes in speed. Thus there are the three indications, speed, time driven and the length of stops. Differentiating these the degree of speed, the time taken for any distance and the number of stops may be ascertained.



Specimen Recordograf Records from a New York Department Store: Fig. 1, Part of the Work of a Horse Wagon; Fig. 2, Portion of the Record of a Motor Vehicle.

The company producing the Recordograf has its headquarters in New York City, and branches in Philadelphia, Chicago, Boston and San Francisco. In New York and where the branches are located the instruments are leased or rented and the supervisors of the company collect the records daily. These are examined by experts, the records analyzed, deductions made and reports made that are submitted to the owners, from which the work done by each vehicle can be learned at a glance. Where branches are not maintained the instruments are sold and the purchasers are instructed in obtaining the facts that may be useful. The company agrees to provide expert testimony in court whenever this may be necessary as to any facts that may be proven by the records.

The collection of the tape by the company and the compilation of the reports prevents possibility of error or tampering, and as the reports are purely disinterested so far as the employee or employer is concerned, and deal only with efficiency, they are in every way dependable. The record shows whether care was exercised by the drivers, whether reasonable time was required to drive a given distance, and if lengthy or unnecessary stops were made. Records covering details of use show really astonishing facts, and curious frauds, some by the drivers and others by customers, and innumerable instances of neglect, carelessness or incompetency, many of these being of such a character as to be quite beyond suspicion until the evidence had been seen.

Two Atlantic electric five-ton trucks in the service of the Kips Bay Brewing & Malting Company, New York City, which have been in use for about four months, as now used by that concern, make two trips daily to South Brooklyn, averaging from 46 to 52 miles to the battery charge. With horses but one trip can be made to South Brooklyn, and the haul is extremely long.

The Motor Truck
Devoted to Motor Driven Business Vehicles of All Classes.

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ELECTRIC VEHICLE HAULAGE.

The electric road vehicle of today represents at least 16 years of practical development. The motor has been utilized in vehicular propulsion for more than 20 years. The first electric delivery wagons were produced for a New York City firm more than 15 years ago, and since that time remarkable progress has been made in design and construction. During the period from 1897 until now the electric machine has been tested, refined and improved, and, strange as it may seem, no principle has been changed. In other words, no weakness has been discovered, but by perfecting the efficiency of the electric vehicle has been increased by several hundred per cent.

With this development of efficiency a material reduction of operating cost has been realized. This increase of efficiency and reduced expense of operation is represented in every vehicle. Concerns that have used electric vehicles for long periods have been taught by experience the need of accurate records and systems, and of the necessity of careful supervision, which have resulted in large saving. A very logical and reasonable assumption is that if a highly successful industrial or commercial enterprise approves organization and administration it does so because of business reasons, and where haulage is concerned the actual result is economy.

The experience of many firms and corporations utilizing electrics with reference to records and organization is worthy the attention of every business man, not from the fact that these machines were used, but because method and administration have developed efficiency. The electric vehicle has its sphere of usefulness, just as has any other type of machine, or the animal vehicle, to its limitations. Beyond these other means of economy must be sought.

DUPLICATION OF DELIVERY.

One of the conditions that has been developed in the recent investigation of the transportation problem in Boston is the duplication of delivery, which means that the cost is materially increased through the maintenance of so many different transportation concerns. In the suburbs of Boston, aside from the store equipments, from three to 24 established express companies are available for transporting goods regularly or casually. It is impossible to say how many different deliveries are made when all of the stores serving their customers are considered, but the number is no doubt very large. So it will be seen that these figures do not by any means represent the actual facts.

Without doubt there is sufficient business to justify the existence of these companies, but it is evident enough that while competition may establish comparatively low prices and probably satisfactory service from one point of view, the expense of maintaining them must eventually be borne by the people. The condition so far as highway haulage is concerned is not to be paralleled by any phase of industry or commerce, and systematization and organization have not been applied, at least with a view to eliminating waste and improving the service. The logical solution would be the organization of concerns that would take over the different companies and operate them as units in different localities, and by this method of operation materially improve the services and lessen the cost.

THE TARIFF REDUCTION.

What effect the reduction of tariff will have in the market for service wagons and trucks is purely problematical. Viewed practically it would appear that the advantage will be more imaginary than real, because, leaving the matter of price aside for the moment, the real demand of the purchaser of vehicles for industrial use is for attention and service, which cannot be afforded without branches and stations in the sections in which a market is found.

The business man requires vehicles that shall be useful as much of the time as is possible, and he does not care to make investment in stocks of spares that might be used eventually, but which represent actual money that could profitably be utilized otherwise. He does not care to buy what may be out of service because of the inability to secure attention, and especially when withdrawals mean actual losses, when this can be very largely insured against. Not only this, the American manufacturers are developing facilities and organizations for protecting the users of their vehicles and better results can be consistently anticipated.

TRYING TRUCKS ON ALASKAN TRAILS.

Trial of White Machine by United States Army Engineers Between Valdez and Fairbanks, On Route That Will Save Time and Expense of Travel, Shows Its Practicability.

THE use of motor wagons and trucks in some parts of Alaska, where the distances are great and the only means of travel are by horses or "mushing", is a possibility for the future, in view of the experience of the United States Army this summer, when, as an experiment, a 1500-pound White wagon was driven from Valdez to Fairbanks and return, a distance of 826 miles, in 19 days. This work was undertaken by the Alaska board of road commissioners, a military board that is entrusted with territorial development of roads within the district, and the result was in every way gratifying.

On Alaskan Trails with a White Truck: A, Road Work Along the Military Telegraph Trail Through a Typical Delta Country; B, Cliff Trail Through an Ice Canyon in the Coast Range; C, Arrival at the Mining Town of Fairbanks; D, Camping on the Guncreek Flats in the Valley of the Delta River; E, Street Scene in the City of Valdez; F, Volcanic Wilderness in the Alaska Range, Through Which a Road Will Be Built.

Alaska is a wonderful country in many respects. The summer season is short and during the period when vegetation develops it grows with amazing rapidity. The autumn season is brief and early in October cold weather is experienced. By late October the rivers are closed by ice and from that time until April the temperature is very low as a rule. Spring is the month of May and then a summer succeeds for a period of about three months. During the months of winter the snow and ice accumulates and with the advent of spring the ground thaws and becomes water-saturated, while the glaciers melt and the streams, at first torrents of icy water, subside to what may be regarded normal proportions late in the summer.

Through this country men first travelled on foot, following the paths of least resistance, generally along the water courses, and later on pack animals were used, but while today horses are found wherever roads exist, "mushing" and dog sledges are the common means of travel, the latter being used during the period when the ground is covered with snow. When the rivers are frozen the ice is generally the roadway, because it at least has the quality of a reasonably even surface, and it is more generally clear of snow, and wherever possible boats are used. On some of the rivers steamboats ply the navigable portions, and in some instances, as along the Yukon, these are the only practical means of travel.

Alaska is a United States district and is controlled as is the District of Columbia, by a commission, which administers its affairs without reference to politics or political preference, and this commission undertakes public work of all kinds, as well as supervising the general development. The road commission has been created to develop highways and means of communication between the different points with a view of having these available the greater part of the time, instead of for several months of the year, and it is now engaged in exploration and some construction work, as well as making surveys and securing engineering information which will be useful in improvements. Naturally the board has examined the trails between different points and given immediate attention to those needs that are greatest.

Valdez is one of the most southern ports of Alaska, and north of it about 350 miles is the town of Fairbanks, this being the head of navigation of the Tanana river, a tributary of the Yukon, which is within two degrees of the Arctic circle. Could this journey be made overland the journey to the interior could be reduced many hundred miles, this being usually made by steamer to the mouth of the Yukon and then up that river and the Tanana. For four years the road commission has been developing a road between Valdez and Fairbanks. There are numerous mountain ranges in southern Alaska, and there are several of these close to the coast and between Valdez and Fairbanks. The Copper river valley is the general highway from Valdez north until the ranges are passed, and then the valleys of the Delta and Tanana rivers are followed to Fairbanks. There are, of course, diverging trails. It will be understood that with the development of the highway from Valdez to Fairbanks the steamer lines will afford communication between all points along the Yukon and as far west as the mouth of that river. Now there is a telegraph line north to Valdez, and there is another that follows the Yukon easterly into the territory.

Few have any conception of the difficulties of travel in Alaska. The rivers are swollen to extreme heights in the spring and early summer, the earth is saturated with water and is soft and yielding, much of the surface of the ground is covered with alluvial deposits that cannot compact, the growth of timber and brush is often heavy, and the trails are often through canyons over bare rock and where the walls are precipitous. Frequent accumulations of snow and ice that are not dissipated until late in the summer and which in melting keep the earth flooded and consequently almost impassable, are met with. These are some of the conditions with which the road commission has to deal in its construction, and the main purpose is to build what will be practical ways, that can be maintained and will permit safe and reasonably fast travel.

One of the greatest difficulties the road commission has to contend with is the short season, but added to this are the facts that the material and supplies have to be transported and the demand for labor is such that men are not always available, nor can they be kept at work when they are attracted by the possibilities of sudden wealth.

The road commission decided to experiment with motor transportation from Valdez to Fairbanks, and practical results were desired and obtained. A standard machine, such as is used in other branches of the army service, was delivered to the road commission at Valdez July 26, and July 28 it was started overland with a load of supplies and mail for the different camps along the military trail. Some of these camps had not received mail for more than a year. Aside from a supply of fuel and tools no special equipment was carried, and the only food freighted was for use in the regions where none other was obtainable.

The departure from Valdez was in a drizzle of rain and the route was across the delta of the Valdez glacier, through the Keystone canyon, 14 miles long, where the trail is amid walls of rock and ice that at times tower to a height of 1000 feet above the Love river, the roadway being in several places a groove in the solid rock. The truck reached a camp known as Workman's that day and the following day the party passed out of the canyon and began a climb of 25.5 miles to reach Thompson's pass at the summit of the Chugach mountains. During this ascent to an altitude of 3000 feet the truck was caught in four snow slides, which, fortunately, had no results other than shovelling snow. The descent was much steeper and this brought the party into a delta, in crossing which a half dozen glacier-fed streams were forded. The stop was at Beaver Dam.

From this point for three days the truck was driven much of the time over trails that had been opened by the road commission within the past three years, and these were in every way far from being roads that could be relied upon. Much of them is a corduroy of scrub timber, narrow and very rough, so that for many miles the party passed through dense scrub and timber, and over immense beds of tundra, into which heavy objects will quickly sink to depths of several feet, but, during the winter, affords a reasonably even surface that can be driven over. These trails are in the deltas of the Copper and Gulkana rivers. Only by wading and determining the nature of the river bottoms could the truck be driven over fords. Over the trails from the Copper river valley to the fork of the Gulkana the surface in many instances was alternately ice and glacier mud, where in some places the wheels were wrapped with rope to secure traction. Many times cutting trees and blasting rock, ice and stumps were necessary before the truck could be driven on. At this point the party was in plain view of Mount Wrangell and Mount Blackburn, respectively 17,000 and 16,000 feet in height, towering skyward, and beyond this Mount Sanford, 14,000 feet high, and an active volcano was visible.

At times the vegetation was luxuriant and again the earth was mere bald rock. Trees, shrubs, brush and flowers grew in wild profusion and game was

plentiful. The Indians were abundantly possessed of fruits and vegetables. The natural beauties of the trail were such as to constantly excite admiration. The grandeur of the scenery amply compensated for the hardships experienced, from the viewpoint of the lover of nature. Following the Gulkana river for three days the party reached Paxson, in the foothills of the Alaska range, and here the military trail led straight north over the mountains, to great heights, showing large areas of the country and many beautiful lakes. Though the average climb was but six per cent., it was at times necessary to ascend grades of 16 per cent. on solid and rough ice. At this time the wheels were wound with wire cable to afford traction, but it did not entirely prevent skidding. Once the edge of a bank crumbled under the weight of the truck and only by great effort was the truck kept from a plunge into a stream far below in a canyon. Near the summit of the range a peak was seen that has the shape of a perfect dome. Nearer the top of the trail the grades were steepest and not infrequently delays were caused by washouts. Several times sharp curves could only be made by use of the reverse.

Descending the range the trail was inspected for considerable distances to insure safety of the machine, and by careful driving the Guncreek flats of the Delta river were reached, where camp was made in a field of mud and quicksand. The following day, after passing a succession of flats and marshes, a long stretch strewn with boulders was traversed, in which movement was only by very hard work for the truck. During this march rain fell. On reaching Donnelly's the first evidence of road work was seen, and for 90 miles the road traversed a surface of clay and gravel, with a fairly good foundation, through a country that was then generally devoid of snow and ice, but is rough and rugged. The road surface was soft in places, but it was a real road as compared with what had been passed over.

Reaching the Tanana river the truck was ferried at McCarty, and followed the other bank of the river to Munson's, and thence to Fairbanks, a distance of 379 miles from Valdez, the destination being reached the ninth day. The truck had made an average of 42.1 miles daily during the trip.

Three days later the machine, laden with supplies and mail to 600 pounds in excess of the normal capacity, was started on the return to Valdez in charge of Lieut.-Col. Richardson, president of the board of road commissioners, who was accompanied by Supt. Ingraham, Lieut. Egerton, Lieut. Steef, Thomas H. Parramore, Jr., and Homer Jones. The start was begun during a heavy rain and the intention was to follow the outward path as closely as conditions would allow. At Guncreek flats three days' rain had obliterated the trail for a considerable distance and there was considerable danger from quicksand. In a number of instances the machine sank into the earth so deeply as to lose traction and hard work was necessary to extricate it.

Approaching Gulkana the party met with a detachment of troops commanded by a first lieutenant sent by the War Department to investigate an alleged gold strike on the Gulkana river. The troop had six pack animals, an army field wagon and a buckboard. Six horses drew the two-ton load, which was largely food for the animals. At Willow creek the party detoured to Chitana, which added 68 miles to the trip, and this required an additional day's time. At Sheep creek, near Keystone canyon, a path of 500 yards was cut through woods to avoid a bad washout, a bridge 12 feet above water when the machine passed it before having been washed away, so fording the stream was necessary. Going through the Keystone canyon the crew had to fill many washouts in the trail with stone to pass over it. One of the discomforts of the trip were the mosquitoes and moose flies, compelling the wearing of net by the members of the party to protect their faces.

Col. Richardson stated after the completion of the trip that when the work now planned for next summer had been completed he believed the machine could go from Valdez to Fairbanks in four days. Following the experimental journey the machine was used for the distribution of mail and supplies to camps and settlements near Valdez. It will be used by the road commission and its further value practically determined.

ECONOMY OF GARFORD TRUCK.

Did Two or Three Times the Work of Horses at Practically the Same Cost.

The Garford Company, Elyria, O., builder of Garford trucks, has information from a company operating a two-ton Garford machine in transfer work in an eastern city, which in a year cost for operation and upkeep $1617.92, as against an expense of $1618.15 for a two-horse team and wagon which it replaced. At practically the same cost the truck did from two to three times the work, affording attention to custom in a territory several times larger and service to patrons that could not be done with the horses. The company handles everything from a small package to a piano, and competition impels promptness in collection and delivery, so that the service practical with the truck has materially increased the gross earnings of the company without additional expense.

The Service Recorder Company, Cleveland, O., is now represented in Porto Rico by the Atlas Commercial Company of Ponce and San Juan. The company now has factory branches in New York, Boston, Philadelphia, Baltimore, Buffalo, Atlanta, Washington, Pittsburg, Chicago, Detroit, Indianapolis, Cincinnati, Minneapolis, Kansas City and St. Louis, and it is represented in San Francisco, Los Angeles, Portland, Ore., and Seattle by the George F. Eberhard Company. The Hopkins-Benedict Company of Chicago has charge of the large volume of railroad business handled by the company.

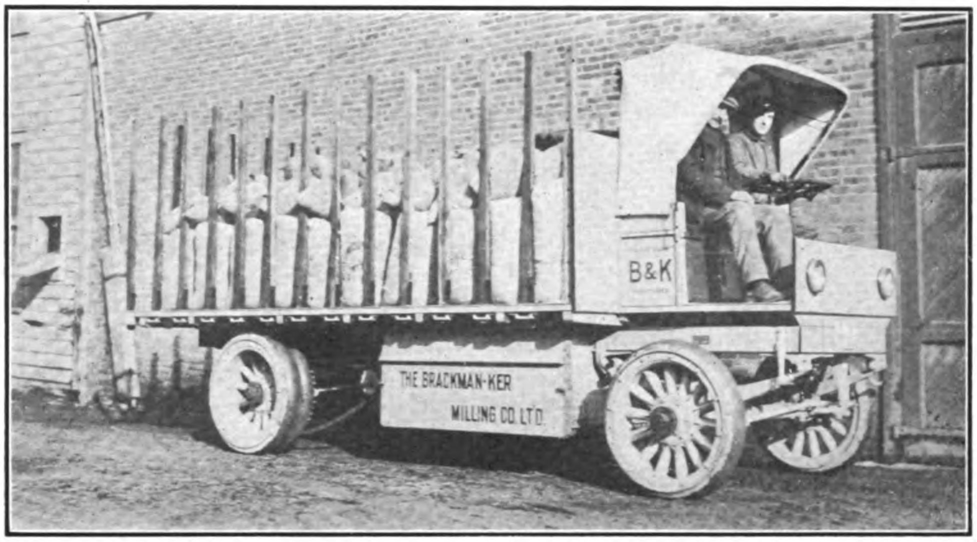
VERSATILITY OF ELECTRIC VEHICLES.

Are Utilized in All Sections of the World with Surprising Success, But Many Manufacturers Are Unwilling to Exploit Foreign Markets.

By F. Nelson Carle.

(Contributed Exclusively to MOTOR TRUCK.)

WE ALL like to see the wheels go 'round, and a great many of us have the small boy's love of the spectacular. Like the savage we want color, noise or rocket like exhibition of speed, power and magnitude.



Electric Truck in the Service of the Brackman & Ker Milling Company, Ltd., at Vancouver, B. C.

The electric vehicle is still misunderstood, perhaps largely because it is out of the ordinary. The blank thing won't act like other automobiles (and I'm afraid it never will). Like the great primal force which drives it, the electric is practically noiseless; goes along about its business without "playing to the gallery," and very seldom gets in the limelight, either through its virtues or its faults. A pair of prancing grays or the "orneriest" Louisiana mule alive can create more excitement in 10 minutes than the average electric truck will in five years.

So it comes to us more or less as a shock that a five-ton electric truck, for example, can adapt itself to any considerable variety of work. To analyze its distribution, for one thing, is to get more or less of a jolt. American made electric trucks are now used in over 40 of the 48 states, and, note this please —in Canada, Cuba, England, Germany, South Africa, Brazil, Australia, Japan, Siam and the Philippine Islands.

Portion of the Electric Truck Delivery Equipment of the El Dorado Brewing Company, Los Angeles, Cal.

When we come to trucking and deliveries we find the electric represented in 122 lines of trade. We find it hauling coal and ice as readily as groceries or beer; moving goods from the 10-cent store and gold from the banks. It pulls great wire cables through manholes, repairs overhead trolley wires, hoists safes and tows disabled cable cars; all with energy from its own battery. The electric works for the junk man with the same enthusiasm as it does for Tiffany, and just to show that it can be real careless when it likes, it capers about the streets with dynamite.

When we come down to special applications of the electric we find it in a class by itself. Indeed the electric motor has found a field of infinite expansion since becoming identified with the power wagon. There is the battery truck crane, the baggage truck, the freight truck, the electric tractor, pump wagon, street cleaner and a score or so of other electrically propelled semi-automatic devices still in an embryonic stage, but are more or less "hooked up" with the storage battery and carried on solid tires.

The advent of the electric into foreign lands is being watched with unusual interest by both American

and foreign truck manufacturers, and the eyes of merchants in distant lands are turned with no less interest toward America. In 11 days a single electric truck manufacturer received inquiries from Hobart, Tasmania; Auckland, N. Z.; Ipoh, Federal Malay states, and Pondicherry, India.

While few manufacturers will feel like attempting to develop an export business until a greater distribution has been secured in this country, the fact remains that the high grade electric possesses the same advantages in foreign cities as it does here. Electricity can be found in some very small towns, and the rates are usually very low. The problem of spare parts, tire renewals, etc., is common to all automobiles, while the handling of battery renewals is offset by practically prohibitive prices for gasoline (from 50-60 cents in the West Indies to 98 cents in Paris, if reports are authentic). At one of the recent shows was a man from Alaska who wanted an electric coal truck, because though he preferred almost anything else (so he said), gasoline was 75 cents a gallon, while he made his own "juice". He didn't get the electric though, because the manufacturer had once sent two trucks into Peru.

That the electric truck will keep pace with the steady onward march of electricity seems obvious. It has economic law behind it and a splendid "big brother" as guide. It has no hard feelings for the gas car—in fact, in older phraseology, it is much beholden to it.

INDUSTRY WANTS GOOD ROADS.

Automobile Chamber of Commerce Advocates Well Constructed Highways.

The executive committee of the Automobile Chamber of Commerce at a recent meeting, after consideration of the subject of good roads in general and the indorsement of the Lincoln Highway project in particular, resolved to approve the proposition, and made a declaration of approval of the principles adopted by the good roads committee of the organization at a meeting of that committee at Detroit.

The executive committee of the chamber has adopted the following: "That we realize thoroughly the necessity of improved road conditions * * * and we believe it is advisable to adopt the construction that, after thorough investigation, will give the greatest permanency, first cost being of lesser importance," which was a resolution adopted by the commercial vehicle committee, which represents 95 of the leading motor vehicle manufacturers of America.

In the announcement of its attitude and policy the Automobile Chamber of Commerce states that the solution of the problem of road building has been given much attention by the motor vehicle industry, emphasizing that many authorities have pointed out that roads are worn very rapidly and the cost of keeping them in even passable condition has increased enormously. Reference is also made to large state bond issues for the construction of highway systems when so far as known no specification has been made for a moderate cost road for which is claimed a life of more than from five to 10 years without resurfacing, even when repairs are made each year. The statement is further made that radical and immediate changes in road building methods must be adopted if the country would keep pace with its industrial, commercial and social needs. In connection with this is the statement that France is to spend $50,000,000 during the next 10 years tarring 6000 miles of roads in addition to an expense of $270 a mile for maintenance and repair to 25,000 miles of national road.

"OIL TOPPINGS," A MOTOR FUEL.

Waste Oil from Petroleum Refinery Develops Large Economy in Trial.

A test of "oil toppings", a refinery product that has until now been regarded as practically valueless, was made by O. W. Kern, who drove a 1500-pound KisselKar delivery wagon from Los Angeles, Cal., to San Francisco, carrying 2000 pounds, in 24 hours and 40 minutes, seems to show that this oil may be commercially useful and that it is an extremely economical fuel as compared with gasoline and other hydrocarbons. The trial was made to demonstrate a new carburetor, which has been designed to carburet kerosene and similar heavy oils, and with a view of showing its qualities the "oil toppings" was used.

"Oil toppings" has been used for a long time for firing boilers and furnaces, and it has a specific gravity of 38.5 Baume as against 59.7 for commercial gasoline, which indicates a much greater density. The carburetor in which it was used is practical, it is stated, with all oil fuels and without change. The cost of "oil toppings" was rated at Los Angeles as three cents a gallon, which shows that consuming 46.5 gallons for the drive of 472 miles, the total expense for fuel was $1.40 and the consumption was one gallon to each 10.15 miles. It is maintained that the "oil toppings" is productive of more heat units and consequently greater power a volume than any of the lighter oils or distillates. The carburetor used is the invention of Harry Miller of Los Angeles. "Oil toppings" has a specific gravity of 41 at 85 degrees of heat and is slow in evaporating and sluggish in combustion unless used with a carburetor that thoroughly vaporizes it. According to the tests made the carburetor gave satisfactory results with "oil toppings", kerosene, a mixture of equal parts of kerosene and distillate, distillate, a mixture of equal parts of distillate and gasoline, and gasoline.

A delivery wagon that will weigh 750 pounds and have a load capacity of that weight is to be built at Detroit, Mich., by the Internal Gear Drive Company, from a design perfected by Albert F. Mais, a well known engineer. Benjamin Marks is associated with Mr. Mais in the new venture.

PRACTICAL CO-OPERATIVE PROMOTION.

Recognition of the Electric Vehicle As a Material Factor in Highway Transportation the Result of the United Endeavors of the Industry and Allied Interests.

By Harvey Robinson.

CO-OPERATION between manufacturers, dealers, supply men, users and electric power interests has been the means of establishing the electric vehicle in the position it now occupies. It has brought the storage battery vehicle from the comparative obscurity of only a few years ago to a position where it is the dominating influence in many fields of delivery.

Harvey Robinson, Secretary, Electric Vehicle Association of America.

Yet even with this accomplished there still remains a great work to be done before the electric will have been established in its relations with other types of delivery wagons. This calls for still further co-operation, and even now the forces are uniting for a campaign whose influence will be felt throughout the country. In its national affairs this co-operation is brought about through the Electric Vehicle Association of America; back of this is the local co-operation between the central stations and vehicle selling agents in each city, and then back of that is the individual advertising of each manufacturer.

Last year the national association carried on a $50,000 advertising campaign that reached millions of people a month. Forty-five mediums were used, and the "ads" were directed to the readers of popular magazines, fashion and social publications, central station bulletins, auto trade journals, physician's journals and a miscellaneous selection of trade publications. Practically the same methods will be followed during the campaign of 1913 and 1914, except that the scope will be wider.

In New York, we who are trying to promote the electric vehicle are confronted by a problem backed up by 120,000 horses. However, motor trucks are making steady headway against the prejudice that for a long time refused to consider anything but horseflesh, where hauling was to be done. Now there are approximately 5000 motor trucks in New York and of these 1626 are electric. These figures are from the official record of the New York Edison Company of Aug. 1. In addition to the trucks there are 525 pleasure cars, making a total of 2151 electric vehicles in New York.

Development by Co-Operation.

It was perhaps 10 or 12 years ago that electrics were first used in New York. From the beginning until 1911 electric vehicle sales were few and far between, for in that year there were but 1200 in the city. When the period over which those sales were spread is compared with the two years in which the sales increased to more than 2100, the value of co-operation may be seen.

It was in 1909 that the New York Edison Company began its co-operation with the local electric vehicle dealers, and it was in the same year that the first steps were taken to bring about the organization of the national body, the Electric Vehicle Association of America.

It has been estimated that by the year 1918 there should be in operation in the United States 300,000 commercial vehicles, and it is argued that by reason of their adaptability to city usage electric trucks should constitute 65 per cent. of this total, or 195,000 machines. Certain it is that without co-operation between the central station company and the manufacturers of the electric vehicle, such a substitution for horseflesh will not be realized.

While much has been said, and central stations have been convinced, of the desirability of electric vehicle business, perhaps too little has been said and too few suggestions offered the central station company as to how it may do its part in the necessary co-operative movement.

Planning for Local Campaigns.

It is advisable that the central station company seeking to build up an electric vehicle business first establish what may be called an "Automobile Bureau." The bureau may in the beginning consist of but one man whose position may be dignified by the title "Automobile Engineer" or "Manager, Automobile Bureau." All automobile inquiries coming to any other department of the company should be referred to the automobile bureau and the bureau held responsible for the answer given. The bureau should be advertised as a source of information for the general public and an effort should be made to arouse confidence in the ability and willingness of the central station company to supply the service of a consulting engineer free of charge.

Four years ago the New York Edison Company established its automobile bureau, and the man placed in charge was instructed that his duty was to co-operate in every way possible with the electric vehicle manufacturers who were selling in New York territory.

After the bureau became acquainted with all local

electric vehicle selling agencies, it set about the task of getting in touch with all local users of electrics. A list of all New York City automobile registrations was obtained from the secretary of state, the electric vehicle owners selected therefrom and listed on cards. A list of customers taking service from the company for charging purposes was next obtained. Calls were then made on all persons whose names appeared on either list, the preliminary record was checked, and a permanent record established. This record is kept on cards which show the name of the owner of the car and his address, the make of the car, where it is garaged, and the source of the charging current, whether Edison service or a private plant.

This list of vehicle owners is kept up-to-date by daily reports from the state automobile registration bureau, and whenever a new registration appears the car owner is interviewed, the purpose of the automobile bureau explained and its services offered. The bureau aims to keep in touch with the operation of every electric in the city, and whenever possible performance and cost data are obtained. A call is made at least once annually on every user in the city. Owners of cars and electric vehicle manufacturers were advised by letter that the company had established an automobile bureau, and stood ready to assist in the care and operation of electric vehicles.

Need of Charging Stations.

The next very important step was the establishment by the company of 22 two-outlet charging stations throughout the city. This network of emergency charging stations covers the city very completely, and it never happens that a vehicle wanting a boost is a too great distance from a supply of charging current.

The automobile bureau of the New York Edison Company is now composed of eight people, one of the number being a lady demonstrator, making demonstrations and giving driving lessons in any of the cars offered for sale in the city. One of our men is an office engineer, who collects and compiles statistics and all performance and cost data he can get hold of. He supplies engineering advice to our service men, and our salesmen, at times going out on special cases himself.

If the electric vehicle purchaser will permit, the bureau will direct the installation of the necessary garage apparatus, and give advice as to proper maintenance of the vehicle. If the purchaser does not wish to care for the car himself, he is supplied with a list of nearby garages where satisfactory advice may be obtained. In this manner the service of the bureau is two-fold, first by arranging garaging facilities for the new car, and secondly by increasing the business of the garage man who is trying to earn a lower rate.

Reaching the Business Men.

Another duty of the bureau is to select and maintain a list of New York business houses now using horse drawn vehicles and whose volume of business handled seems to warrant the adoption of a more economical mode of transfer. This list is circularized at intervals and attention is drawn to the advantages to be derived from the use of electric trucks. A reply to one of the letters being received, a representative immediately calls and determines the requirements of the case, submitting interesting performance data, and figures on cost of operation and maintenance. He also has with him a list of satisfied users of electric vehicles. With the prospective purchaser's permission his name is sent by letter to the local representatives of the different electric vehicle manufacturers, with the request that descriptive literature be sent and followed by a salesman. The automobile bureau becomes acquainted with the salesmen on the case and keeps in touch with the progress made, giving information where it is wanted on the cost of charging current and the necessary charging apparatus.

The company spends a goodly part of its advertising appropriation on electric vehicle publicity. Space is purchased in both newspapers and magazines, and each advertisement carries the names and addresess of all electric vehicle selling agencies in the city. Copies of our advertisements are always sent to vehicle manufacturers, irrespective of whether they are represented in the city or not. It is interesting to note that two years ago there were but eight or nine manufacturers represented in New York, while at the present writing there are 21 agencies or branches.

Creating Locality Interest.

The central station company should take the lead in the formation of a local electric vehicle association. Meetings might be held monthly, or oftener if desired, and everyone in any way interested—users, prospective users, manufacturers and selling agents—should be invited to hear the reading of papers prepared by competent men and to join in a discussion which may follow. An association may also readily undertake the arrangement of what may be called public demonstrations or publicity stunts. The "get-together" spirit must be worked up. Interchange of experience and ideas will make for better progress.

An encouraging indication of the progress of the electric vehicle in commercial service is the fact that within the past two years a number of gasoline truck manufacturers have added, or are arranging to add, electric cars to their output. Gasoline car manufacturers are noted for progressiveness and it is evident that these concerns have read the signs of the times and have moved accordingly.

During the year 1912 the New York Edison Company supplied charging current to about 1000 electric vehicles, the aggregate current consumption thereof being 6,012,309 kilowatt-hours. Today we are supplying current to 1335 electrics, or 62 per cent. of the total number operating in the boroughs of Manhattan and Bronx. Consumption is at the rate of 8,000,000 kilowatt-hours a year. More than 300 cars have been added since the first of this year to the total number of electrics operating in New York, and it looks as though the end of the year will see the total increased by between 700 and 800.

An analysis of the total number of all kinds of motor trucks operated in New York City shows that 75 gasoline truck manufacturers represented in New York City have sold 2300 trucks, or less than 31 trucks a manufacturer, while 14 electric truck manufacturers represented have 1850 electrics, or 132 a manufacturer.

While manufacturers of electric automobiles and central stations are to be congratulated upon what progress has been made during the past two years, much work still remains to be done before the electric vehicle may even divide with the gas car the country-wide business that is now in sight.

ELECTRIC VEHICLE TIRE EQUIPMENT.

By T. H. McGiehan, General Manager, Motz Tire & Rubber Company, Akron, O.

IN PERFECTING an ideal tire for electrics two fundamental qualities must be incorporated in order to make a dependable tire. These properties are resiliency and durability, and naturally they are both dependent upon many variables such as compounds, shape of tread and method of fastening.

The most important is the general construction of the tire. The tire must be designed so that the minimum amount of energy is consumed in propelling the vehicle. Conservation of power is the one most important factor in the maintenance of an electric car.

Therefore the resilient and durable electric tire that covers more miles on a battery charge is the only tire for electrics. Every time a solid tire strikes a road obstruction it takes added power to lift the car over, but when the tire absorbs the shock all the power is used in carrying the car in an onward instead of an upward direction.

Not only are cushion tires far superior to solid tires in saving fuel consumption, but they are also an important factor in prolonging the life of the mechanical parts of the machine. In this comparison the pneumatic tire comes in for an equal amount of credit, but the Motz cushion tire goes one step farther; it is trouble proof.

When you consider that the electric pleasure vehicle is the most popular car for women because of its ease of manipulation, then you can readily realize why practically 90 per cent. of the electric vehicle manufacturers specified Motz cushion tires for their 1913 equipment. Women cannot and should not be expected to repair a blow-out or puncture any more than they should be expected to crank a motor. It was essential that the manufacturers equip their machines with self-starters. Naturally the woman buyer was partial to a machine with this equipment. This made driving for her much more of a pleasure as it overcame a large amount of trouble.

Therefore it was up to some one to invent a tire that had all the qualities of a pneumatic tire and with one thing more—puncture proof. In being able to produce a cushion tire that contained the resilient qualities of a pneumatic and moreover the durability of a solid tire, a wonderful achievement was accomplished in the tire industry.

In connection with this it might be said that throughout the many experiments of attempting to produce an efficient pneumatic tire for electrics that would consume less power than the regular pneumatic tire for gasoline cars, many difficulties presented themselves which necessitated either the sacrifice of durability to make the tire faster or the sacrifice of resiliency to make the tire more durable. In the cushion tire for electric vehicles both of these qualities are contained without sacrificing the one to obtain the other, which affords an all-around, efficient and trouble proof electric tire.

NEW HORNER TRUCK.

Detroit-Wyandotte Motor Company Organized to Produce Horner Models in Grabowsky Plant.

The Detroit-Wyandotte Motor Company, Detroit, Mich., has been organized with George A. Horner as president, and associated with him are John Baker, Jr., as sales manager, R. A. Parker as assistant sales manager, Morris Pierce as service manager and William Parkin as chief engineer. The company has acquired the plant of the Grabowsky Power Wagon Company and the purpose is to produce a machine that will be a refinement of the Grabowsky design. The Horner truck will have increased accessibility, more power, and will be considerably simplified. The company will conduct a service department for the benefit of owners of Grabowsky machines. Mr. Horner was the manager of the Grabowsky Power Wagon Company during the period it was conducted for the benefit of the creditors.

GAS PRODUCER TAXICABS.

Chicago Concern Is to Give Coleman Device a Test in Active Service.

The Owen H. Fay Livery Company, Chicago, Ill., has made contract for the equipment of 50 of its machines in general passenger service in that city with Coleman gas producers, and it is expected that these will be ready for operation by the first of the coming year. The company tried kerosene for fuel without the degree of success expected, and believing that there would be more or less loss of business in the event of starting delays, decided to adopt the gas producers, which utilize coal for fuel. This is in line with an endeavor to economize the cost of operation, and the belief that, in all probability, there will be no decrease in the cost of gasoline.

POWER ECONOMY FROM BALL BEARINGS.

Practical Application of These Journals in Electric Vehicle Construction—Their Relation to Efficiency and Conservation of Energy Through Minimized Frictional Loss—Forms That Are Commonly Used in Practise.

By Victor W. Page, M. E.

THE electric automobile differs essentially from those propelled by steam or gasoline engines, because it derives power from stored energy obtained from a charged reservoir which becomes depleted in direct ratio to the demands made upon it. The electric vehicle designer is confronted with a problem of magnitude which does not receive the same consideration from designers and engineers associated with the development of the gasoline automobile, and that is to secure maximum efficiency of power producing and transmitting elements in order that the charge of electric current available in the battery be conserved to the utmost.

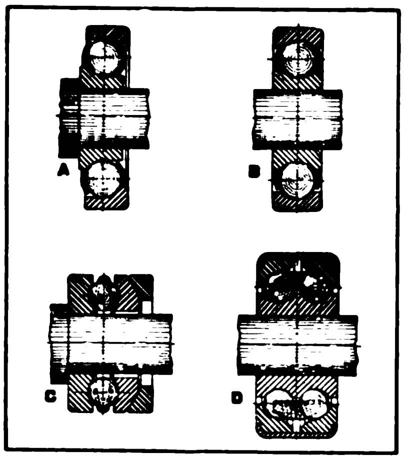


Fig. 1—Types of Ball Bearings That Have General Application: A, Cup and Cone or Adjustable Type; B, Single Row Form for Radial Loads; C, Ball Bearing for End Thrusts; D, Double Row Bearing, Combined Radial and Thrust.

In the gasoline automobile the power is generated as needed and as long as the engine functions properly, the energy required to propel the vehicle is available. The matter of securing maximum efficiency is important, but is not given as careful consideration as it must have in those types of vehicle depending upon stored power. The real power capacity of any automobile is that delivered at the traction wheels, not the amount of energy produced by the prime mover or available in watt-hour capacity of storage battery. Before the power can be applied to driving the vehicle it must pass through a motor, which transforms the electric current to mechanical energy, after which it is transmitted by mechanical means, such as reduction and drive gearing, to the traction members. There is an inevitable loss in converting electrical to mechanical energy, but this cannot be compared to the large losses due to friction and power absorption by gearing, etc.

Purpose of Discussion.

The writer proposes to confine himself to the largely preventable friction losses in bearings and will endeavor to make clear how a reduction of friction by using properly selected anti-friction journals of the ball type will increase the aggregate efficiency of the vehicle to which they are fitted. It is common knowledge that a plain bearing has more friction than one of the ball or roller type, and it is also conceded that the ball bearing is the most efficient of all because it has the least friction. An impression prevails in some quarters that bearing friction is a matter of little moment and that there is so little difference between the various types that all anti-friction bearings will save approximately the same amount of power. Careful laboratory tests show that this impression is erroneous and based on a misconception which is fostered to a large extent by those interested in the promotion of the less efficient types of bearings.

Bearing Type an Important Factor in Design.

The average electric vehicle owner or mechanics associated with him have full knowledge of the main parts of the mechanism, but some of the components are apt to be overlooked because they are not as conspicuous as others and may be considered unimportant. Among these parts are the bearings used for supporting all rotating shafts and those employed in the wheels supporting the vehicle weight. To many, the

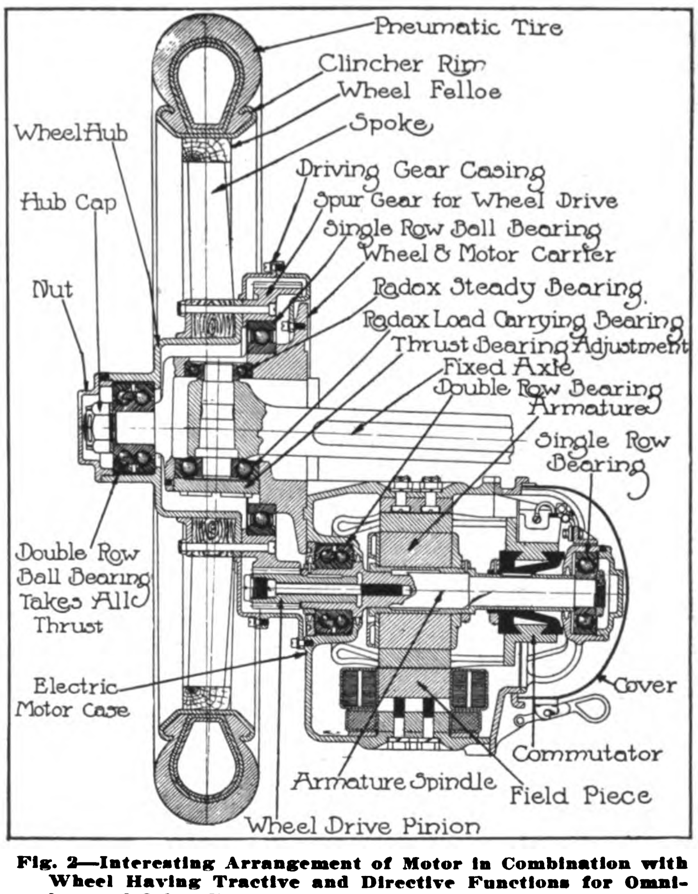


Fig. 2—Interesting Arrangement of Motor in Combination with Wheel Having Tractive and Directive Functions for Omnibus and Other Urban Use—Note Use of Ball Bearings at All Points.

type of bearing is of little concern as long as it does its work fairly well, but there is a great difference between several types of bearings used and it is important to know which are the most efficient at a time when minimum cost of operation and maximum efficiency and endurance are important considerations in determining the suitability of the various vehicle types for commercial work.

Friction of Bearings Compared.

A number of experiments have been made with fine instruments to determine the relative friction of the various forms of bearings. The results of these experiments demonstrate that the coefficient of friction of a well oiled plain journal will vary from 2.5 to five per cent. of the load applied. The friction of roller bearings has been determined by Prof. C. H. Benjamin to be about one-half or two-thirds that of the plain bearing, the coefficient ranging from 1.75 to three per cent., whereas a ball bearing, which has a coefficient of friction of but one-tenth of one per cent., has about 1-20 the friction of a roller bearing and from 1-25 to 1-50 of the friction of a plain bearing. Other authorities are somewhat more conservative in regard to friction of bearings, but an analysis of most of the accept-

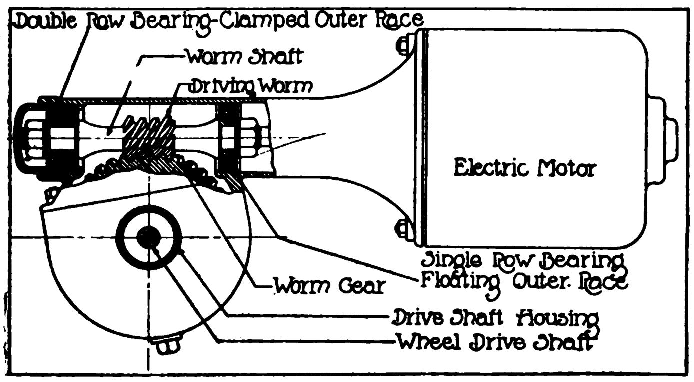


Fig. 3—Combined Power Producing and Driving Element Using Ball Bearings to Support Worm Shaft.

ed published literature and reports of tests has supported the writer in considering the average coefficient of four per cent. for plain bearings, one per cent. for roller forms and two-tenths of one per cent. for ball bearings. This means that a plain bearing takes 75 per cent. more power than a roller bearing and 95 per cent. more power than a ball bearing.

The following simple formulae will enable anyone familiar with ordinary arithmetical processes to determine the amount of power needed to overcome friction of plain and anti-friction bearings with sufficient accuracy to make intelligent comparisons between them:

For plain bearings: $H.P. = .0000003 \times P \times d \times rpm.$
For roller bearings: $H.P. = .000000075 \times P \times d \times rpm.$
For ball bearings: $H.P. = .000000015 \times P \times d \times rpm.$

In the above let P equal load in pounds; d represents diameter of journal in inches for a plain bearing and diameter of circle drawn through the centres of the balls or rollers of an anti-friction bearing, while rpm represents revolutions per minute of shaft supported by the bearings under consideration. The constants are based on the values previously given for coefficient of friction.

To show the practical application of the formulae, let us consider a bearing three inches in diameter under a load of 5000 pounds at a speed of 100 rpm. This would correspond to the load on one 36-inch rear wheel of a loaded three-ton truck making a speed of 10 miles an hour.

$H.P. = .0000003 \times 3 \times 5000 \times 100 = .45$ for plain bearing
$H.P. = .000000075 \times 4 \times 5000 \times 100 = .15$ for roller bearing
$H.P. = .000000015 \times 4 \times 5000 \times 100 = .03$ for ball bearing

It will be evident that the plain bearing will take nearly .5 horsepower, a roller bearing will need .15 horsepower, while a ball bearing will consume but .03 horsepower under the same conditions of load and speed.

Ball Bearings Show Positive Saving in Current.

Changing this into watts will give some idea of the saving in electrical energy if anti-friction bearings of the ball type are used. If one considers an efficiency of 85 per cent. to allow for losses in motor windings and wiring, there will be 878 watts drawn from the battery for each horsepower delivered by the electric motor. To overcome the friction of the one plain bearing considered as an example the motor must consume 395 watts, whereas the ball bearing will necessitate the use of but 26.34 watts. When one considers the number of bearings in an electric automobile and that all of these require the expenditure of power to overcome their friction, it will be apparent that a material increase in effective radius of action a charge of battery may be obtained from a ball bearing electric vehicle over exactly the same construction fitted with bearings that consume more power.

Why Ball Bearings Have Little Friction.

The ball bearing has less friction than the roller bearing for several reasons, the most important being that the rolling members are true spheres and that there is no tendency for ball deformation to produce the wedging and disalignment so prevalent with rollers. The balls of a properly designed bearing bear at two points diametrically opposite. Even under deformation, due to the load, these points do not increase materially in area and thus cause spinning or sliding of the balls, as the natural tendency of the ball to roll is not interfered with. A ball may turn around in any direction on account of its spherical shape, and there is practically no friction between the balls and the separators because this member is not employed to restrain ball rolling. The two areas or zones of contact of a ball are always diametrically opposite and there is no condition in the ball bearing with properly formed raceways that will produce friction under practical service conditions.

Those who favor roller bearings advance the contention that a roller bearing has more surface than a ball bearing. This is true, but the same argument could apply to the plain bearing, which has infinitely more surface than that present in either a ball or roller form. It will be seen that the amount of surface avail-

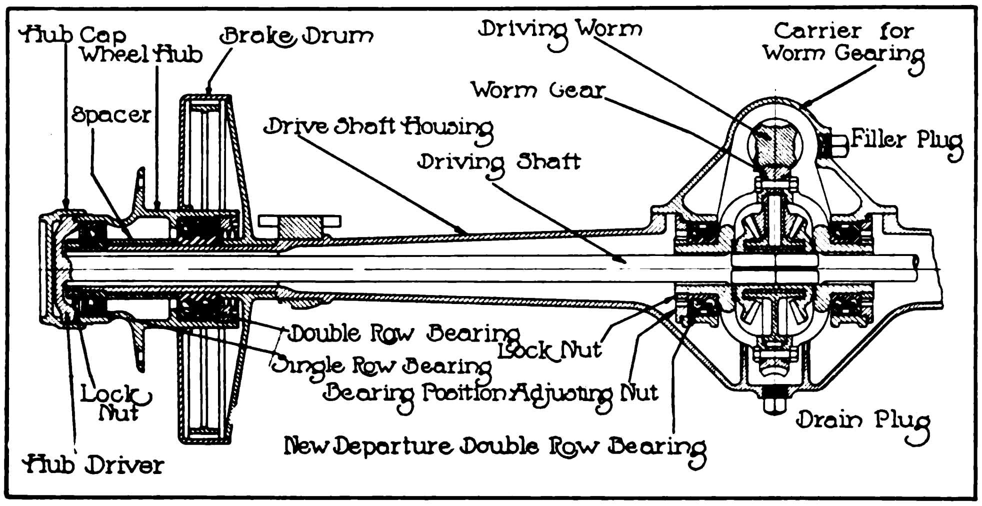


Fig. 4—Worm Drive Axle of the Full Floating Type Suitable for Electric Vehicle Service on Account of Ball Bearing Support of All Revolving Load Carrying Members.

able to support the load is not the only condition that makes for bearing efficiency. In reality the form of bearing with the greatest surface is that which experience has demonstrated consumes the most power, wears out the quickest and gives the most trouble. The modern business man would not purchase an automobile that was mounted entirely on plain bearings. With the present charges for electric current, lubricating oil and repair work, such a machine would be much too expensive to operate. A power plant of about twice the capacity of that now used in the car equipped with anti-friction bearings would be needed, and the hill climbing ability and general capacity would be much lower than that of the more efficient vehicle with but half its power. The matter of friction is, then, one that must be considered important. It is apparent that the forms of bearings which have the least friction will be the most economical and satisfactory in service. Not only will they provide superior speed or greater mileage for a given amount of electricity, but they will have much longer life, and will be practically free from trouble, because the most accurately built bearings are those which have the fewest weaknesses.

It is contended that ball bearings must be more accurately made and fitted than are either roller or plain bearings, and that as a result they are more delicate and not so suitable for general application. It is true that the component parts of a ball bearing are very accurately machined. In fact, the balls are machined so closely that those in any one bearing do not differ from each other, either in sphericity or adherence to standard size, by more than one-tenth of one-thousandth of an inch (.0001 inch). It is not difficult to produce spheres, commercially, to these limits, while it would be extremely difficult to manufacture rollers in a commercial manner that would be so uniform in size. It is this care in manufacture that makes ball bearings superior as friction eliminators. The closely fitted, accurately machined parts, which have no waste movement or lost motion, insure that the load will be distributed more evenly than would be the case if the bearing were made without this extreme accuracy. It is not true, however, that a ball bearing is delicate or not satisfactory for general application. When properly selected they will carry any load that any other form of bearing will withstand successfully, and will do it with less consumption of power than any other form.

Ball Bearing Forms Used in Practise.

The various forms of ball bearings are shown in illustration, Fig. 1. That at A is a so-called adjustable type, having the load line at an angle so that it is precisely like the tapered roller bearing, in that it is capable of withstanding a radial and a thrust load or the angular resultant of these two. It also shares with the tapered roller bearing the disadvantage that it can take angular or thrust loads from one direction only, and that is the one which tends to bring the bearing members more firmly into contact.

The bearing shown at B is the conventional single-row annular form that has been widely applied. This type will resist radial loads and can also withstand a small amount of end thrust, though conservative bear-

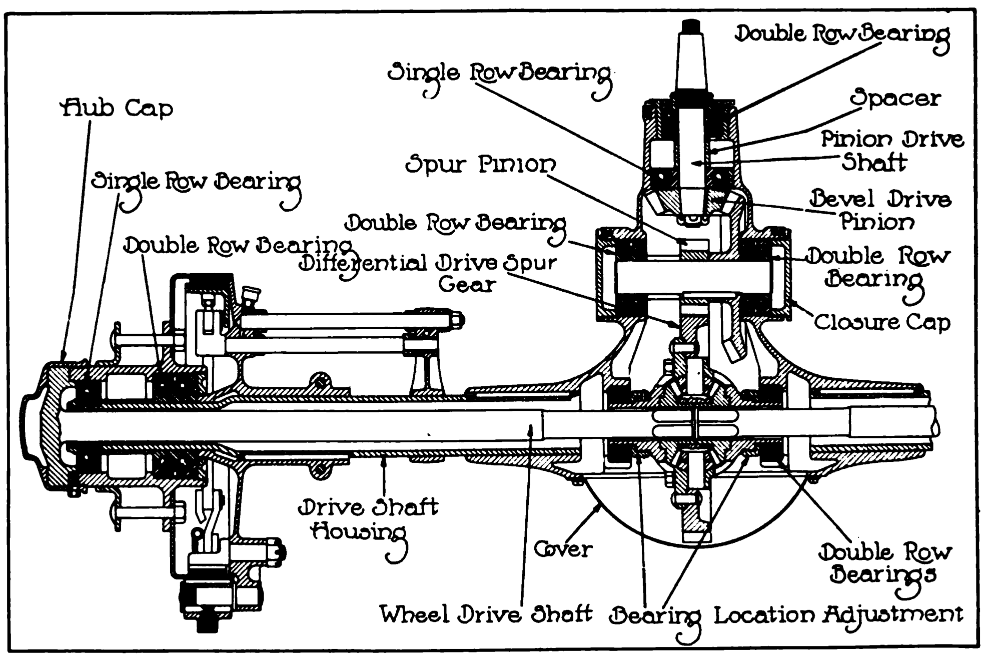


Fig. 5—Double Reduction Axle of Full Floating Type for Electric Vehicles.

ing manufacturers do not recommend it for this purpose. The radial capacity of this bearing is higher than that of any other single-row form and it operates with less friction loss than any other commonly employed type of bearing regardless of design. The bearing at C is intended to take thrust loads only and is generally used in combination with the radial form shown at B.

At D a unit bearing is shown which is capable of taking end thrust from either direction and sustaining a radial load as well. This form of bearing, owing to the two rows of balls, has a higher radial capacity than a single-row form of equivalent bore and outside diameter, and at the same time can be employed to successfully replace any other combination of bearings necessary to do the same work.

If bearings of the so-called adjustable type are used and the loads are applied as angular resultants from both sides, two of these bearings must be used and they must be mounted in such a way that the tendency

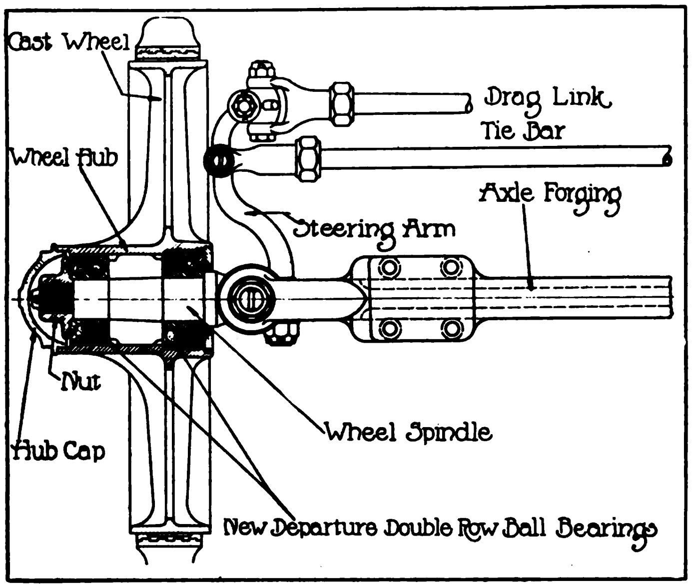


Fig. 6—Front Wheel Assembly of Heavy Electric Truck Axle Showing Double Row Ball Bearings.

of the loads applied to them will be to bring the balls and races firmly together. If one utilizes the forms of bearings which have been devised to carry radial loads only, it is necessary to add a distinctive form of thrust bearing to resist the end thrust. For this reason the double-row form of ball bearing having angular load lines is without doubt the most satisfactory bearing for general application, because it is a complete unit capable of withstanding radial loads in excess of the capacity of any single-row bearing of the same bore and outside diameter, and includes a high degree of resistance to thrust stresses from either direction at the same time. This one unit will replace successfully any combination of thrust and radial bearings, whether of the plain or anti-friction type, in any application.

Where Ball Bearings Are Used.

The main points where ball bearings can be used to advantage are at the motor armature bearings, on the power transmitting gear shafts and in the road wheels, both front and rear. The drawings presented are of actual applications that have been used successfully in electric vehicle practise and are interesting in that they show designs of various essential components as well as the methods of using ball bearings at the important bearing points. Considering first their application to electric motor armature support, the reader's attention is directed to Fig. 2, which shows an interesting method of motor suspension and wheel drive following foreign practise. The motors are applied directly to the wheels and all four wheels are used for driving as well as steering. The motor is attached to an extension of the wheel carrier in such a manner that the entire motor and wheel assembly oscillates when steering. Owing to small ground clearance this method of motor suspension is suited only to vehicles intended for city use, such as omnibuses, heavy trucks, etc.

An internal spur gear is secured to the wheel and this is driven by the spur pinion attached to the motor armature shaft. The motor shaft is supported on ball bearings, one of the double-row form being placed next to the spur drive pinion, while a single-row bearing suffices to support the other end of the armature. The wheel carrier is mounted on a large ball bearing of the thrust type and steadied by a smaller one above the axle. This insures easy steering. The wheel itself revolves on ball bearings, the outer one, or double-row type being depended on to carry its share of the radial load and take end thrusts as well. The large inner bearing is a single-row type subjected only to radial loads.

Current Saving in Ball Bearing Motors.

In connection with the use of ball bearings for motor armature shaft support, let us first consider the saving of current made possible by their use. A series of tests were made to determine the relative efficiency of a three horsepower motor with armature mounted on plain bearings in one instance and on ball bearings in the other. The plain bearing motor was but 75 per cent. efficient, while the ball bearing motor showed an efficiency of nearly 90 per cent. It is said that current used on electric automobiles will cost 20 cents a kilowatt-hour if derived from the storage battery carried by the vehicle and in most cases even more by the time it reaches the motor brushes. On this basis and figuring a saving of 10 per cent. in current for ball bearings, a commercial vehicle that runs five hours a day for 300 days a year will save current enough, if these bearings are fitted to a six horsepower motor armature only, to save about $150 a year of current costs. This does not consider the saving made possible at bearing points of running gear or power transmission system.

Ball Bearing Motors Have Other Advantages.

Ball bearings have other important advantages when used in electric motors besides current saving. In the first place maintenance costs are reduced because they do not need constant lubrication or adjustment. As there is no perceptible wear in such bearings, the armature will not run down on the pole pieces, as is possible when plain bearings deteriorate. Good com-

mutation is insured because of steady armature running and as bearings do not depreciate the air gap or space between armature and field magnets remains constant. As ball bearings occupy but little space, a motor of 25 per cent. more power can be designed with no greater overall length than a plain bearing type of less capacity.

Ball Bearings for Worm Drive.

An interesting application of ball bearings to a drive gear assembly of the worm type is depicted at Fig. 3. The motor casing is attached directly to the axle as the drive is by a worm carried by an extension of the armature shaft. In this case not only the armature of the motor is mounted on ball bearings, but the drive gearing as well. As considerable end thrust is present with a worm drive, the double-row bearing is especially well adapted for worm shaft support. It is housed in such a manner that it is capable of resisting end thrust present either on forward or reverse drive and carry its share of the radial load as well. The single-row bearing at the motor end of the worm shaft is mounted with a floating outer race and takes radial stresses only. This construction permits the worm shaft to expand if heated without stressing the bearings.

A longitudinal sectional view through the axle assembly to which this worm drive is applied is clearly outlined at Fig. 4. The worm gear is attached to the differential assembly, and the entire gear group is supported by a one-piece gear carrier integral with electric motor case as shown at Fig. 3. The axle is a full floating type, the wheels being mounted on the axle housing tubes and the shafts are used only for driving the wheels. The method of supporting the differential assembly in the carrier by two double-row bearings offers advantages of moment. One of the essentials bearing on worm gear drive efficiency is accurate centring of the worm and gear with which it meshes. This can be done very accurately by the bearing position adjustment nuts, which make it possible to locate the differential assembly so the centre line of worm wheel will coincide or register with that of worm shaft. This insures correct worm contact and the elimination of heat and wear. The double-row bearings can take all thrust on differential case with minimum friction.

The wheel mounting is typical of modern practise. The inner bearing of the double-row form takes all wheel end thrust, but is assisted in resisting the radial loads by the single-row bearing. Both bearings are mounted on the drive shaft housing tube and the floating drive shafts or differential assembly may be removed without disturbing wheels or alignment of gearing.

When an electric motor is employed as a source of power it is necessary to use a low ratio of drive between motor armature shaft and road wheels because of the great difference in the speed of armature and traction members. This is usually accomplished by compound gearing of some sort. A double reduction rear axle of the full floating type showing the application of ball bearings throughout is outlined at Fig. 5. The drive from motor is to bevel pinion, which turns a bevel gear on the countershaft. Attached to this countershaft is a spur pinion that imparts motion to a large spur gear on the differential case assembly. Two reductions of speed are thus provided between motor and wheels.

A Ball Bearing Double Reduction Drive Axle Design.

As will be evident, an axle of this type would be very inefficient if parts were mounted on power consuming journals because 10 bearings are required in this assembly and unavoidable gear losses are high enough without adding bearing friction losses. All thrust on the bevel pinion drive shaft is taken by a double-row bearing at the front end, while the major radial load is sustained by the large single-row bearing immediately back of the bevel drive pinion. The countershaft revolves in two double-row bearings, so arranged that position of bevel gear may be accurately gauged relative to bevel drive pinion. The differential assembly is also supported on double-row bearings. The wheel, a full floating type, is supported by a combination single and double-row bearing mounting as previously described.

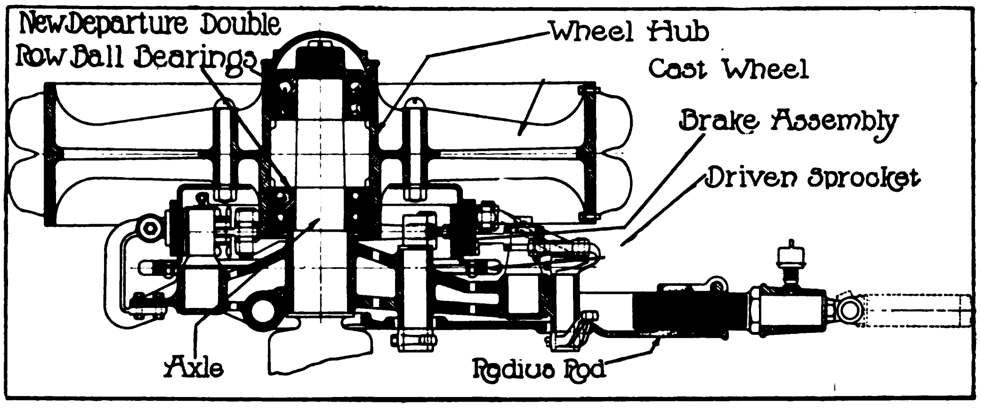


Fig. 7—Wheel End of Rear Axle of Heavy Electric Vehicle Showing Method of Mounting Wheel on Ball Bearings Supported by Stationary Axle Spindle.

Ball Bearings for Heavy Vehicle Wheels.

The front wheels of an electric vehicle are subjected to considerable end thrust when turning corners, as well as carrying a portion of the vehicle weight. The front hub assembly depicted at Fig. 6 is a typical construction suited for a heavy electric vehicle. The wheel, which is a steel casting, revolves on two large double row bearings mounted in such a way that each is called upon to resist end thrust and radial loads as well.

A rear wheel such as employed on the heavier commercial vehicles using axles of the "dead" or non-revolving type is clearly outlined at Fig. 7. The various parts are clearly shown and the method of mounting is practically the same as for the front wheel at Fig.

6, so further description is unnecessary. The important advantage the double-row bearing principle of construction offers where large loads are to be supported with bearings of comparatively small diameter is clearly outlined in these wheel mountings. If single-row bearings were used, the hub would be 33.3 per cent. larger in diameter to house bearings of sufficient radial capacity, yet these would not have the thrust capacity the lesser diameter double-row forms have.

The loads to be sustained by wheel bearings are high and they are subjected to considerable shock and vibration, especially in commercial vehicles fitted with solid rubber tires. If ball bearings will answer successfully the requirements of this service, it is apparent that their adaptability for all other parts of the car, where the loads are less severe, must be admitted. If they are used at points where the stresses are high, in order to reduce friction to a minimum, there can be no question of their endurance and saving in power where loads are lower. In view of the foregoing it is not difficult to understand why the best engineers favor ball bearings for electric vehicle service, and why practically all high-grade cars, even those sold at moderate prices, utilize ball bearings at all points where maximum efficiency is desired.

The Bavier Lubricating System, Inc., has been organized by George H. Duck, former manager of the New York service department of the American Locomotive Company, and Charles H. Bavier, which will establish in New York City a plant for the production of a new lubricating system for motor vehicle engines.

J. F. Sheppard & Sons, ice dealer at East Braintree, Mass., has entirely motorized its transportation department with KisselKar wagons and trucks.

HOLLOW STEEL TRUCK WHEELS.

Sightly Appearance of This Form of Equipment on a Large Passenger Vehicle.

Those who have doubt as to the appearance of steel wheels when used with machines that are to be utilized for passenger transportation, and assume that such equipment is not as sightly as those constructed of wood, generally form such opinion without definite knowledge of fact. The design of the steel wheels produced by manufacturers is generally such that it is hardly probable that the casual observer would discern the difference, and it might be that with the paint and varnish covering the metal there would be no condition that would attract attention.

The purpose of the makers of steel wheels is generally to produce what will be conventional in appearance, have sufficient strength, lightness and endurance to justify their use, and aside from the fact that there are usually fewer spokes than when constructed of wood, there is no real difference when contrasted with wooden wheels. These wheels are built to the S. A. E. standard dimensions and may be utilized with any form of tire, either quick detachable or demountable, and have all the qualities of the wooden wheels fitted with steel rims.

Double-Decked Passenger Omnibus with the Fischer Electric Steel Wheels, Demonstrating the Sightly Appearance of the Equipment.

An idea of the appearance of the wheels in service may be gained from the accompanying illustration, which shows a double-deck omnibus fitted with the Fischer electric steel wheels, these having hollow spokes and rims, and it will be noted that these have six spokes for the forward wheels and eight for the rear, while the average wooden wheels would have 12 forward and 14 rear. The sole American agent for these wheels is Peter A. Frasse & Co., 417-421 Canal street, New York City.

The assets of the Grand Rapids Motor Truck Company, Grand Rapids, Mich., successor to the Decatur Truck Company, have been purchased by Frank T. Hulswit for $17,000 at a bankruptcy sale, of which $6500 was the equity of the receiver in bankruptcy.

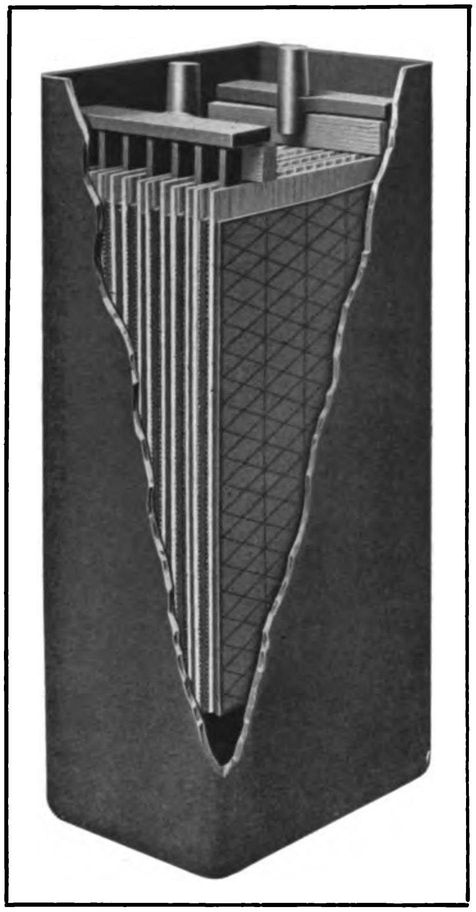
The S. G. Gay Company, Ottawa, Ill., has begun the manufacture of a 1500-pound gasoline delivery wagon, which will have the four-cylinder motor under a hood, and will be driven by chains. The vehicle will be known as the Gay wagon.

ELECTRIC VEHICLE PRACTISE.

Development of Cell Amperage by Use of Thin Plates, Increasing the Surface Area and Lessening Weight, With Better Construction Insuring Endurance---Examples of Wood and Rubber Separators, Straps, Terminals and Connectors.

By William W. Scott.

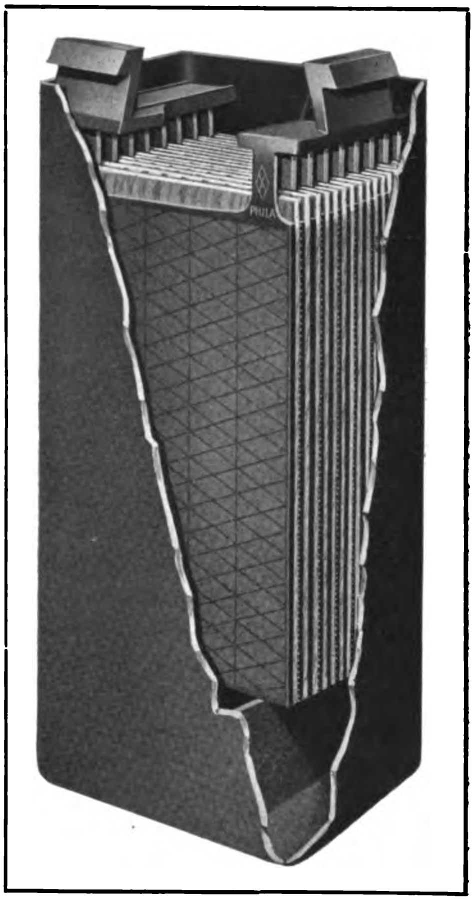
THE first plates produced were efficient so far as capacity was concerned, but the cells were heavy and it was apparent to battery engineers that it was essential to construct what would have less weight, so that in the last six years special attention has been directed toward producing what would have high efficiency and with as much reduction in weight as was possible. While it is not probable that the maximum has as yet been reached, a very large progression has been made by some manufacturers, comparison being made with earlier productions.



Philadelphia Thin Plate Cell, Assembled with Pillar Straps.

An example of this may be shown in the Philadelphia "thin plate" types, the development between 1906 and 1912 being in the use of thinner plates. The original W battery cell contained 11 plates and with a weight of 34 pounds to a cell had 140 ampere-hours capacity. The 13-plate cell weighed 33.75 pounds and had 168 ampere-hours capacity, this being an increase of 20 per cent. The 15-plate type weighed 33 pounds and had 189 ampere-hours capacity, an increase of 35 per cent., and the 17-plate cell weighs 32.5 pounds and has 204 ampere-hours capacity, an increase of 45.7 per cent. It will be understood that while the reduction of weight was comparatively small the plate area was much larger, and this really gave 64 ampere-hours because of the greater plate area exposed to the electrolyte. In this progression the main problem was the construction of the plate, so that, with its decreased thickness, it would have the strength to endure and afford efficiency under all requirements.

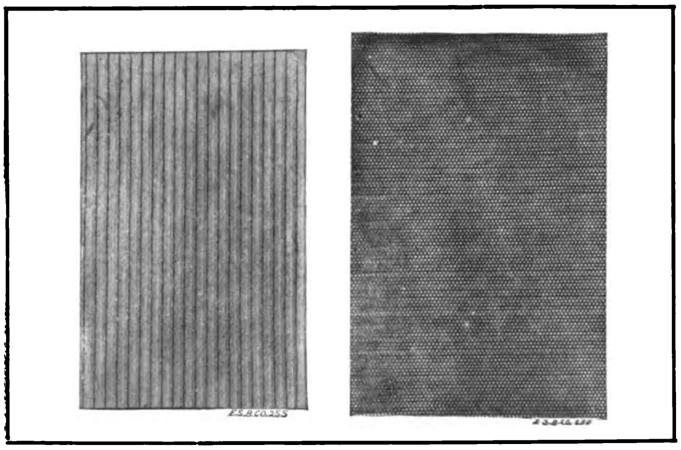
That is, the endeavor was to produce a thin plate that would endure practically as long as one of greater weight, and which would have the greater capacity because of the increased number used in a cell. Battery cell plates to be economical must have a definite life, and engineers have sought to construct what will have long endurance and the largest practical capacity. The cell that would not endure would be more expensive than that more enduring, its capacity would deteriorate in like ratio, and it would not be regarded as dependable, while the user would lose materially through withdrawals from service for attention, to say nothing of the lessened radius of movement of the vehicle through the reduction of capacity.



Philadelphia Cell Assembled with L-Straight Strap at Left and L-Plate Strap at Right.

Lead battery cells are widely used because they have been found to be commercially practicable with reference to cost, endurance and efficiency. The research work of chemists and engineers during the development period of the lead battery cell, which covers a period of more than half a century, has established that no couple that can be economically produced has the potential that is obtained with electrodes of sponge lead and lead peroxide and an electrolyte of dilute sulphuric acid. Innumerable tests and experiments have

been made in chemical constituents of acid battery cells, and to determine action and reaction, but no combination of metals has been found that yields as



Typical Lead Cell Separators, Channelled Wood at Left and Perforated Rubber at Right.

great a potential. The alkali or nickel-iron battery has not been considered in the above statement.

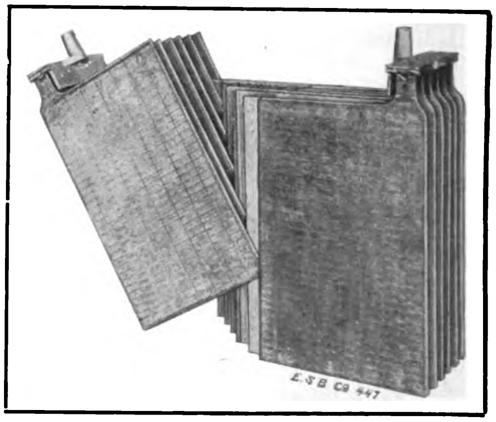
The electromotive force between electrodes of sponge lead and lead peroxide submerged in an electrolyte of sulphuric acid and water of approximately 1.225 specific gravity has been found to be about 1.94 volts, and with the increase of the specific gravity of the electrolyte the electromotive force is increased considerably, but there is no difference in this potential with the size of the cell. The voltage value of a cell can be rated at two or more, according to the state of the active material and the electrolyte. Voltage will vary with the temperature. For the purposes generally used the cell may be charged so that it will show a voltage of 2.5 or 2.55, and the cell when discharged to the degree regarded as safe will have a voltage of approximately 1.8, showing that the variance in potential is about .7 or .75 volt. These are the maximum and the minimum voltages that should be permitted.

The life of a cell is really based on cycles, that is. the number of complete charges and discharges it is given, and if the maximum results were to be obtained these cycles should be completed, and with regularity, for it will be remembered that sulphation or the formation of lead sulphate is a result of the electrolyte upon the lead plates. The minimum of discharge is fixed because there will be excessive formation of sulphate upon the plates, and as this sulphate is greater in volume than the lead or lead peroxide from which it is formed the surfaces of the plates will be insulated, the lead peroxide cracked or loosened and the material eventually dislodged, while the pores of the sponge lead plate will be filled with crystals of sulphion. In other words, the discharge of the cell below a voltage of 1.8 will cause sulphation that will only be dissipated with unusual care and attention, and may necessarily cause deterioration and deformation of the plates. Because of the possibilities of damage from careless use or neglect a plate must be sufficiently rigid to withstand the stresses, and as the thinner plate must be lighter it must also be better designed.

As the frame or grid metal cannot be changed much depends upon the design and construction, and as the active material must be retained in the grid the method of retention must be positive. Thus the thin plate must be developed with unusual care, and development can only be accomplished by lengthy experiment and careful observation. It will be noted in the case of the Philadelphia thin plate that the weight has been but little reduced, but the surface area exposed to the electrolyte has been decidedly increased. Sponge lead and lead peroxide have no high degree of conductivity, and as the thin plate is expected to have greater potency the frame must necessarily be so designed as to afford as thorough and even conductivity as possible.

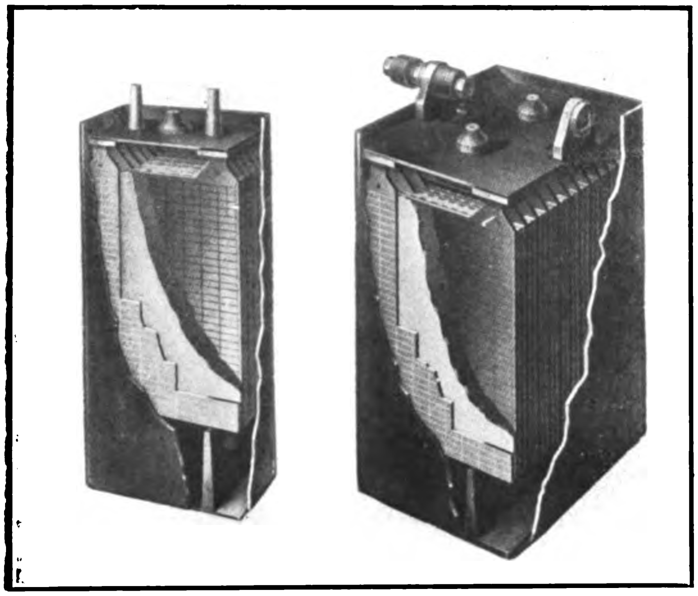
The influence of the electrolyte is greatest upon the positive plate. It will expand during the period of "formation" and during its service there will be more or less expansion and contraction of the lead peroxide, but the effects upon the negative plate are comparatively small, the changes not being of a character to materially affect it. There is, of course, necessity for securing good electrical contact between the plate frame and the active material, for otherwise there will be local action and reduced conductivity. Theoretically the action of the electrolyte upon the plate should be uniform, but this is not realized in practise, though the desire is to secure rapid diffusion of the electrolyte and the equalization of the concentration differences, for this is of great importance where cells are to be charged and discharged at high rates. The main objects to be obtained are capacity, freedom from excessive sulphation, the maintenance of potential during quick discharge, as well as endurance. In fact the general efficiency of the cell is absolutely dependent upon the quality of the plates.

Every battery cell manufacturer of importance in the industry has a department devoted to development. This is in charge of chemists and engineers, and the experiments are conducted with extreme care. For obvious reasons these departments work without publicity. No results are made public and nothing is permitted to reach a competitor, because there is the supposition, at least, that this would result in a direct loss, and a single determination may represent a large amount of money. In other words, whatever is accomplished scientifically is regarded as a trade secret,



Lead Cell Element with the Plates Practically Separated to Show Manner of Interleaving Them in Assembling.

and it is carefully guarded. Each manufacturer has his own processes and seeks to obtain whatever commercial advantage may be gained by their use. There



Sectional Views of U-S-L Battery Cell Construction: At Left, a Pleasure Vehicle Type and at Right a Design for Truck Propulsion.

are specific principles that are applied, but the use of these may lead investigation into what may seemingly be strange channels. But aside from the chemistry of battery cell construction, different tests are made, these to determine endurance, capacity, results during different conditions of charging and discharging, accelerating, and varying factors that are essential or incidental to the development.

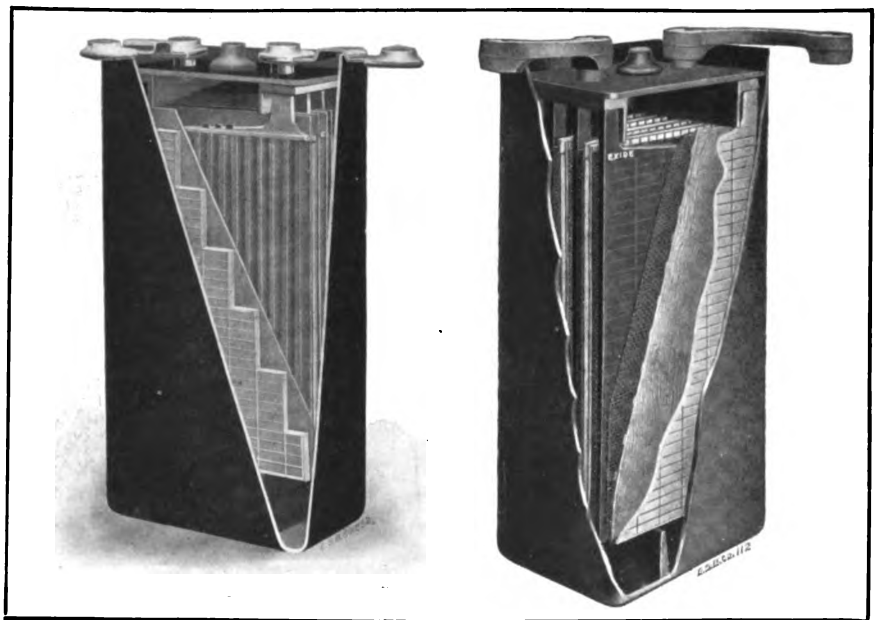
With reference to known active material and electrolytes it may be said that it is possible to determine the theoretical weight of either that would be required to produce a desired result, but these will vary in practise because it is impossible to obtain the porosity of the plates or the degree of penetration of the electrolyte. There is a gain in weight of approximately 15.5 per cent. in the conversion of metallic lead to lead peroxide, and a corresponding reduction in the conversion of lead peroxide to lead. Generally speaking, from three to six times the weight of metal is required in the plate because of the impossibility of exposing all the metal to the electrolyte.

The volume of electrolyte for a cell is determined by the engineer according to formula, the factors being the ampere-hour discharge, the initial density of the electrolyte and the terminal density at the expiration of the discharge period, and it is practical to obtain definite data on the basis of the known chemical changes. The quantity that is placed in a cell is only what is necessary to insure a desired action, for an excess would accomplish no useful purpose and the added weight would be a disadvantage rather than an advantage, for one object in successful construction is to minimize weight.

In the making of a battery the basis is number of cells, each of which is normally rated at two volts and whatever amperage the size will justify. As each battery as ordinarily coupled is with the cells in series it will be understood that this means the battery has the amperage of any one cell, but the combined voltage of the group, and if a voltage of 110 were required this would necessitate the use of 44 cells, and the amperage would be a given output of any one cell at the eight-hour discharge rate.

Thus to accomplish a definite work the engineer takes whatever number of cell units may be required and with them grouped for convenient handling (if for vehicles) he couples them and the battery is ready for use.

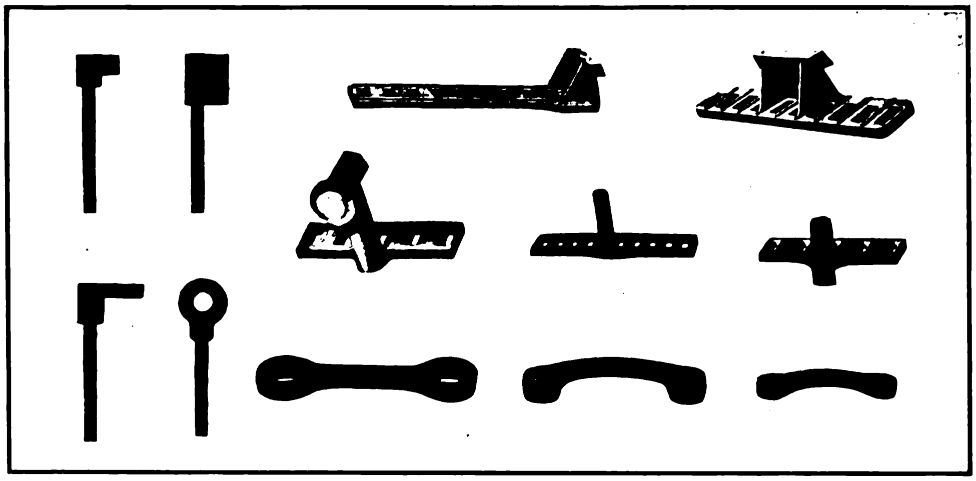
The plates for the cell, as has been shown, are made with an extension of the frame, which may be at the centre, at one end, or a neck formed at one side, which is of such length as may be necessary with the form of the jar. This neck or lug serves as a support for the plate when assembled, and it is composed of the same material as the frame. In the assembling of the element, as the series of positive and negative plates are known, all of the negative plates and all of the positive plates are coupled into separate groups. There is always one more negative than positive plates in a cell, for this permits the full value of the positive plates, and the coupling may be made by a bolt or rod, with collars to separate and preserve the relation of each plate, passing through a hole in the neck or lug; or the top of the lug may be placed in a hole in a strap or rod



Details of Construction of Exide Cells: At Left, Ironclad-Exide Cell with the Type of Connector Used with This Type; at Right, Cell Connected with Pillar Straps.

of metallic lead or composition of lead and antimony and connection made by tightening a nut; or the end of the lug and the strap may be fused to form a solid

metal connection. Whatever the method, the purpose is to form a perfectly dependable conductor of electric energy to the terminal, which is formed on the strap.



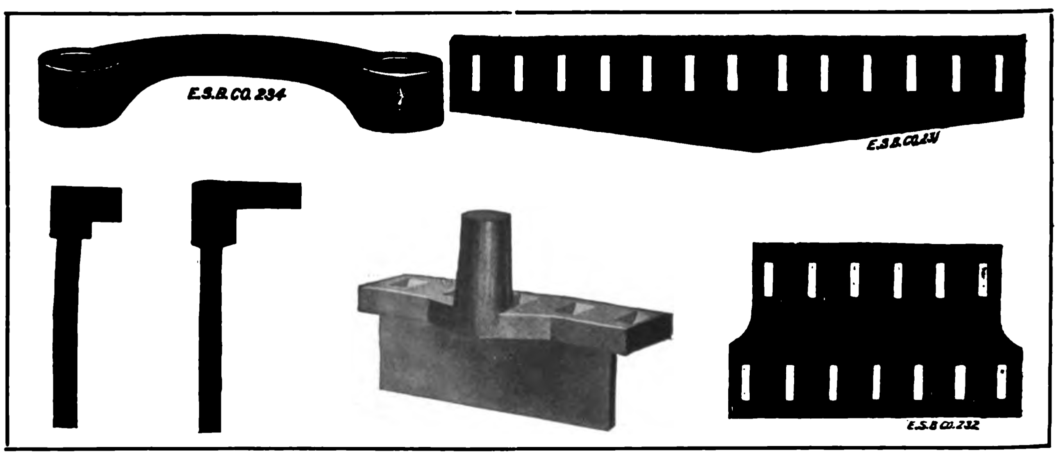
Straps, Connectors and Terminals: From Left to Right, Upper Row, Rear and L-Type Lead End Wire Terminals, L-Straight Strap and L-Plate Strap; Middle Row, S-Post Strap and Terminal, R-Post Strap and Pillar Strap; Lower Row, Front and R-Type Lead End Wire Terminals, S-Post Strap Connector, Pillar Post Connector and R-Post Strap Connector, Used with Philadelphia Cells.

The cell may be of hard rubber or vulcanite for electric vehicle use, but for other purposes it may be a glass jar, while for large cells it may be a wooden box or envelope lined with sheet lead. Considering the vehicle cell, the purpose is to have what will not be affected by the electrolyte and will be light in weight and sufficiently strong to endure under handling and to withstand the shocks that may result from driving. Usually hard rubber is found to give the best service, and the jars are made with a depth of several inches more than the length of the plates. The majority of the cells are made with several high ridges extending across the bottom, these affording a support for the element, and the space below is of such depth that the particles of active material separated from the positive plates will not accumulate sufficiently to reach the bottom of the element. In some of the cells the "bridges" are from two to three inches in height, and are generally several in number. These strengthen the jars and considerably improve their durability.

As the jars are to be enclosed in crates a rectangular form is chosen because of the better shape for packing, and because this the better economizes space, as well as affords the greatest capacity. The plates are generally of greater length than width, as may have been noted from the illustrations, and the difference between the two dimensions is at times considerable. The long and narrow plate may be considered the standard for electric vehicle use for several reasons. First, the floor area of the average battery box is small and cannot be increased without complications and limitations, and it is necessary that a definite number of cells be carried. This means that the base shall be small and the shape an oblong. The depth of the cell is approximately the length of the plate and the neck or lug, plus the space required for the bridges. Because of the necessity of limiting weight the walls of the cells are as thin as is practical, the thickness being dependent upon the use to be made and the general knowledge of the strength of the material.

It is apparent that to minimize weight the volume of electrolyte is kept to the lowest that is practical, a condition that is not essential with cells used for other forms of installations, and aside from having a sufficient quantity in the cell so that the loss through decomposition of the water will not have material effect no other condition is essential.

The cells are assembled by the manufacturer and in this work much care is taken to have the jars, the plates and the separators perfectly clean. The element is made up with the positive plates coupled by one connector, strap or bus bar, and the negative plates similarly connected. With the average assembly there is one more negative plate than positive, and between each positive and negative plate are two separators, which snugly fit and keep the plates in exact relation. The separators may be of different materials. In stationary cells glass or hard rubber rods are sometimes used, but in cells intended for vehicles the separators are generally of wood and rubber, or of rubber. There



Straps, Connectors and Terminals: From Left to Right, Upper Row, Pillar Strap Connector and Top of High Burned Straight Strap; Lower Row, Style D Terminal Connector, Style C Terminal Connector, Pillar Strap with Apron for Holding Down Separators, Top or High Burned Plate Strap, Used with Different Types of Exide Cells.

is an exception to this in the case of the "Ironclad-Exide" cell, in which the active material of the positive plate is contained in horizontally slotted rubber quills that are ribbed so that the ribs contact with the negative plates and maintain them at a precise relation.

The wood and rubber separators in sheet form are generally slightly longer and wider than the plates. The reason for the greater size is to prevent the "growth" of the plates extending across the space at top and in this manner causing a short circuit. Sometimes the top of the grid frame is sheathed with thin rubber, which is intended to allow expansion and contraction and at the same time prevent the possibility of "growth," this sheathing extending downward from the top member of the frame for a sufficient distance to insure against contact. As the element is assembled the separators are so placed that the tops project above the plates for perhaps .375 inch. Because the cell is practically closed and there is variance in the height of the electrolyte a corrosion of the plates is probable wherever exposed above the liquid, and this corrosion is prevented touching the plates by the separators.

The wood separators are about .140625 inch thick and of different materials, but often of basswood, which has a considerable degree of porosity. In these sheets are made on one side longitudinal channels about two-thirds as deep as the sheet and perhaps .125 inch wide, with the ribs formed by the channels about the same width as the grooves. Woods in their original state contain different elements in different proportions, some of them of acid nature, and were the woods used in this condition the resultant chemical action would be of serious consequences. The possibilities in this direction are of no special interest to the reader, but to the chemist are decidedly attractive. To eliminate these elements from the wood separators they are subjected to chemical treatments that neutralize or abstract them, so that when treated they have the cellulose structure and the strength of the wood and the electrolyte in which they are submerged for long periods is not in the least affected by them.

The channels in the separators are made both longitudinal and transverse with reference to the grain. One of the faults with the longitudinal channels is the probability of splitting, because the wood between the ribs is extremely thin and will not endure much handling, especially when dry. The channels transverse of the grain greatly reduce the danger of splitting and from the viewpoint of the battery engineer afford a stronger and better separator with the same weight. The function of the separator channel is to insure a circulation of the electrolyte between the plates. In assembling the smooth side of the separator is placed in contact with the negative plate.

The rubber separators used with wood separators are sheets of very thin hard rubber perforated with many minute holes through which the electrolyte contacts with the surface of the positive plate, and they are placed between the positive plates and the channelled sides of the wood separators. When all rubber separators are employed two are placed between each negative and positive plate. One of these is ribbed, as are the wooden separators, and the webs between the ribs are perforated with many small holes. The other is the thin perforated sheet.

The reason for the use of the thin rubber separator is to protect the positive plates against the disintegrating influence of the movement of the electrolyte against them, as well as to prevent the charring or carbonizing of the wood from the heat of the positive plate. With the element assembled the effect of the thin rubber separator is much the same as a cover or envelope and there is a sufficient contact of the electrolyte with the active material. Where rubber or glass rods are used these are placed at intervals between the plates and the electrolyte is allowed free access to the surface of the plates. As the active material is more or less porous the electrolyte saturates it, and it permeates the pores of the sponge lead, and there is sufficient influence to afford the rated capacity of the cell.

In battery manufacture the technical name of the neck of the plate is the plate lug, which is made thicker than the plate itself to insure strength to carry the weight and the better resist the corrosive influences of the electrolyte. Each group of plates is coupled in an element by a means of positive connection, and very generally by what are known as straps. The straps are cast from lead and are designed for different size cells, each having a series of taper holes, usually rectangular, into which the plate lugs are fitted. These straps are of different forms, some having aprons or webs that extend downward, being intended to maintain the relation of the separators; others are merely flat sections with the openings for the plate lugs, and again others have terminal posts or lugs, which are used with hard rubber rods and strips to hold down the separators. Because of the necessity of having absolutely certain conductivity and the possibility of loss at joints from imperfect contact, the general custom is to unite the plate lugs and the straps by fusing the metal at the joints, this process being known as "lead burning."

Where the straps are of the flat type the rubber "separator hold down" strips and rods are used, these being placed under the straps and over the tops of the separators, although in some cases these are kept in place by the cell cover. The cell cover is a sheet of hard rubber that is slotted to fit the lugs and aprons of the straps and when it is installed it is usually retained by a sealing compound, generally a composition of bituminous material, that is not affected by the electrolyte, and which is applied in a heated or plastic condition. This is removed by breaking or cutting when access to the element is desired. In the cover is a hole that is closed with a soft rubber plug in which is a small vent to liberate the gas. In this condition there is but little if any loss by slopping and through

this opening water can be placed in the cell as desired. By it also the electrolyte can be sampled by a hydrometer syringe, or by a hydrometer placed in the opening. Each cell is a complete unit and as many may be used as is required for any purpose, the number being limited only by the voltage that may be necessary or the space in which they may be grouped.

(To Be Continued.)

WILL ADVISE TIRE USERS.

Campaign of Education of Wagon and Truck Owners Begun by Manufacturers.

The Automobile Chamber of Commerce has adopted a resolution prepared by the commercial vehicle committee to the effect that a pamphlet on the cause of solid tire wear and destruction be prepared and published by the commercial vehicle department of the organization, and that manufacturers of wagons and trucks be requested to mail copies to all their customers, and that publicity be given through the daily and periodical press.

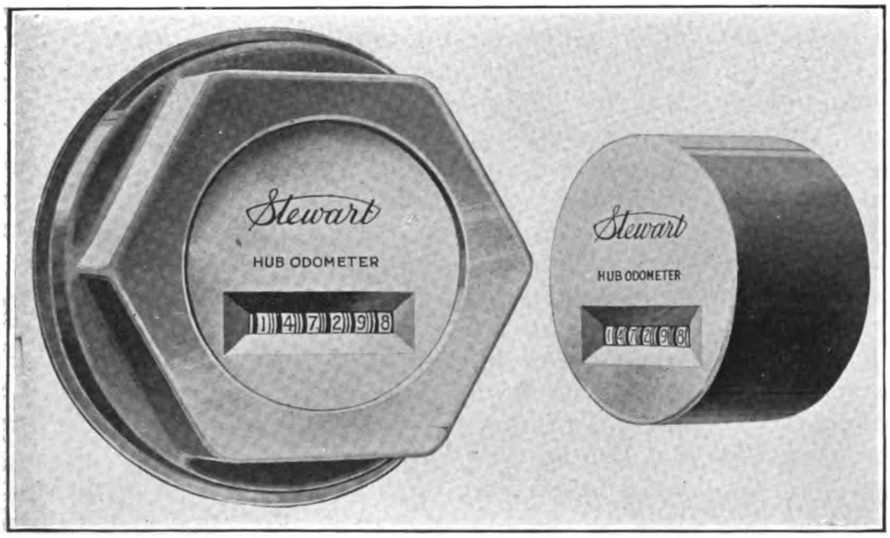
Advice has been sought from tire manufacturers, which will be included in the publication, but it was assumed that disinterested information from the truck builders would more influence the users than would statements made by tire makers, who are required to make replacements because of mileage guarantees. Emphasis is made to users that neglect of tires not only makes the first cost more than it would be did not the tire companies make good the damage resultant from abuse, that the burden of making replacements under the guarantee falls upon all users of tires alike, and that in preserving tires the user minimizes the wear upon the vehicle and lessens the repair expense.

The commercial vehicle committee has given the subject of tires study for a year, considering the effects of topography, paved streets, the effects of overloading and excessive speed, bad distribution of loads, sudden starting and stopping, inadequate tire equipment, diameter and contour of tires, the greater mileages obtained from solid tires in Europe, the human element to be dealt with and the probable result of offering bonuses to drivers. The belief is that by the adoption of different methods greater mileage can be obtained from tires and the cost of operation correspondingly reduced. The purpose of publishing the pamphlet is to reach the owners who may be or have been indifferent as to the operation of machines, and to correct ignorance or lack of knowledge of those in charge of or operating the vehicles.

STEWART HUB ODOMETER.

Speedometer Corporation Brings Out New Device for Recording Vehicle Movement.

The Stewart-Warner Speedometer Corporation, Chicago, Ill., has placed in the market a new hub odometer that may be utilized with any electric or gasoline vehicle, and it will record the movement of the vehicle accurately by tenths of miles up to a total of 100,000, when the register will return to zero and continue as before.



The New Stewart Hub Odometer for Either Gasoline or Electric Vehicles, Showing the Instrument in the Hub Cap and Removed.

This is the first instrument of the kind produced by this concern and with the knowledge of the requirements for service vehicles great care was taken in development. The odometer is enclosed in a substantial metal case that will fit inside the hub cap, and the end of the cap is cut away so as to expose the end of the odometer case and the register. When installed it requires no further attention.

It is operated by a positive drive that will not fail, steel pinions being used with worm and spiral gears. Each pinion is machined from steel and is heat treated and hardened to endure wear. By the use of an adaptation of the "Geneva stop" the registering dials are locked save at the instant of registering, and there is no possibility of a movement of the dials unless an indication is made. There are no springs or pawls in the instrument and when installed it may be regarded as thoroughly dependable. The dial is amply protected and with the miles shown by black numerals on white, and the fractions in red on white, the register can be easily read.

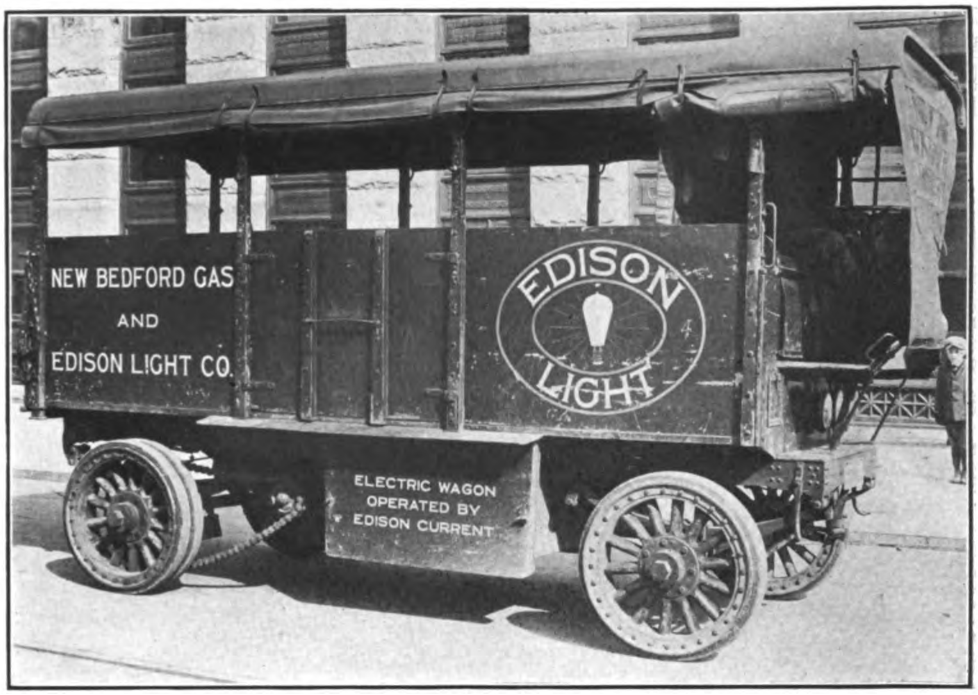
The Frank Parmalee Company, Chicago, Ill., which conducts a general baggage transfer service in that city, has purchased nine three-ton White trucks and will use them in its general transportation between hotels and residences and the railroad and steamship terminals. The company also uses a six-cylinder touring car in its work.

DEVELOPING POSSIBILITIES OF LOCAL FIELD.

New Bedford Gas & Edison Light Company Sets Example for Other Central Stations--- Some Results of Its Experimentation with Various Makes of Electrics.

CONCERNS engaged in the production of electric current are in a position to appreciate the value of studying the local field with a view to determining the possibilities for developing the use of electric trucks and wagons. A particularly interesting example is that of the New Bedford Gas & Edison Light Company, New Bedford, Mass. Having become convinced of the possibilities in that city, this concern has taken steps to place itself in a position to enjoy its full share of the business when it shall have been developed. The methods employed are such as to make an appeal to other central stations.

While the company has obtained information which leads it to believe that electric vehicles are much more economical in operation than horse drawn wagons, and for this reason is adopting them for its own use to a large extent, it is not prepared as yet to make public comparative figures. Its position is due in no small measure to the fact that even with its use of automobiles the business has grown so rapidly and the character of the service has changed to such an extent that it has found it necessary not only to keep all of its original horses, but to hire more teams outside than heretofore. Aside from the factor of economy, the company finds that the great advantage in the use of automobile equipment lies in the ability to accomplish the work more quickly, thus giving prompt service to its customers, a factor which it believes of sufficient importance to outweigh even that of economy.



The Giant of the Fleet; 3.5-Ton G. V. No. 4, Utilized in Hauling Coke, Etc.

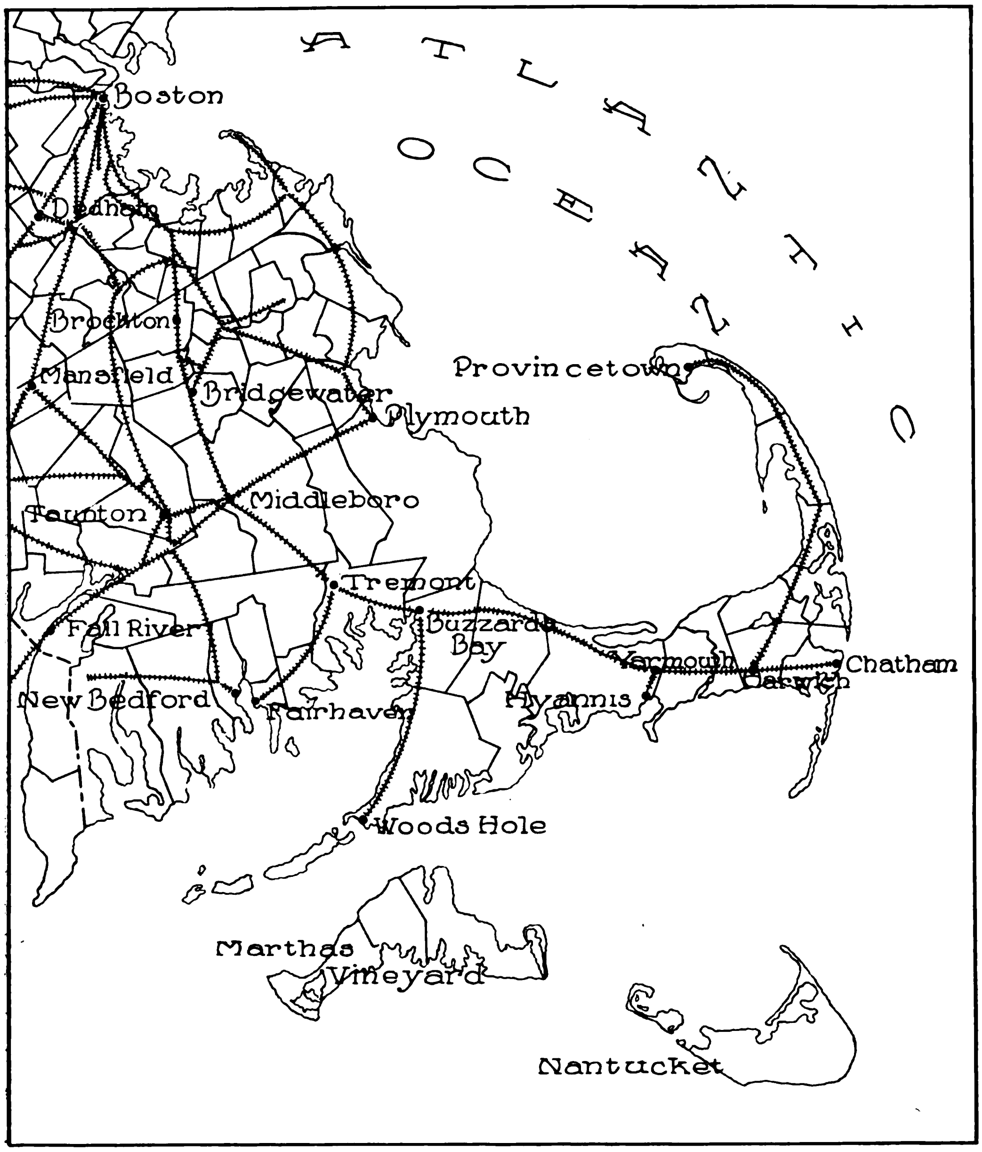
New Bedford is located on an arm of Buzzards bay, at the southern end of Bristol county, in southeastern Massachusetts, and about 56 miles from Boston. The Acushnet river separates it from Acushnet and Fairhaven on the east. It is bounded by the town of Dartmouth on the west, and on the north by Freetown. A little study of an accompanying map will suggest the limited area from which the city draws trade to itself. Fall River, with a population of 119,295 in 1910, is a near neighbor, only about 12 miles to the northwest, and is a formidable rival. Direct railroad communication between Boston and Cape Cod, with frequent service, tends to draw business that might otherwise be attracted to New Bedford, toward the Hub. The few small towns lying between this main line railroad and Bristol county have a certain choice between New Bedford and Boston. Out at sea, the Elizabeth islands, Martha's Vineyard and Nantucket offer a field of activity that is not neglected. Good boat service is maintained between these and the city proper, and on Martha's Vineyard, in particular, several well established motor 'bus and transfer lines insure prompt delivery of goods shipped thereto. The population of New Bedford, according to the 1910 census, was 96,652.

The city has an extreme length of about 10.7 miles and a width averaging 1.8 miles. The major portion of the residential district is located on top of a hill, the crest of which is about half a mile distant from the water front. This statement is general, and is for the purpose of indicating that the longer streets run in a northerly and southerly direction on top of the hill or along its sides. Those at right angles thereto do not present steep grades, and it is possible to cover a large portion of the city without encountering difficulty in this respect.

A map of the city, presented herewith, sets forth the arrangement of the streets, and the location of the principal factories, with which New Bedford is plentifully supplied. Aside from its whale fisheries, with an annual product valued at over $300,000, the city has some 65 cotton and yarn mills, operating over 2,500,000 spindles, or about 10 per cent. of the whole number in the United States. These mills use approximately

300,000 bales of cotton a year. There are a number of other industries, and the city is a large coal distributing centre, having steamship connections with New York City. Many sailing vessels also ship from this harbor.

It will be noted that New Bedford is somewhat distinctive in the arrangement of its business centre, so-called. In reality this is distributed at three points, as indicated on the map. The main centre is disposed about the streets leading up the hill from the water front, and, of course, those immediately adjacent thereto. Here are to be found the large wholesale houses and many of the department stores and retail establishments, hotels, etc. The business district to the north is quite as well defined as the so-called main centre, and somewhat the same may be said of that to the south, although neither of these is as important as what might be termed the central distributing point.



Map of Southeastern Massachusetts, Indicating Limited Area Served by New Bedford Business Men.

Most of the streets have excellent surface, macadam, bithulithic and asphalt being the materials generally utilized. A few of the older ways, down near the water front, are paved with cobbles, and some of them are in very poor condition. It is seldom necessary to traverse these, however, in making deliveries either from the wharves or the railroad freight station. The city government appreciates the value of good streets and every effort is made to extend the system as rapidly as possible.

Much of the raw material, aside from cotton and coal, is shipped to New Bedford by rail. Very few of the factories have their own sidings, over which the cotton and coal is loaded onto freight cars at the wharves and delivered directly at the door. Much of the coal is sent inland, and, of course, this is shipped by rail. These points are emphasized, because they have a direct bearing on the use of motor trucks and other conveyances.

The railroad freight station is on the water front level, about midway between the main business centre and that at the north, the distance between these two being a matter of 1.5 miles. The southern retail district is about a mile from the main centre. It is hardly practicable to define these limits with accuracy, since freight is deposited, either by rail or boat, at various points along the water front, extending from the railroad freight house at the north, down past the city wharves, and almost to the upper end of the southern retail district.

The wholesale and retail houses naturally are called upon to make deliveries in the section served by them. It has been pointed out that this section does not reach far inland, and, of course, the goods delivered on Martha's Vineyard and Nantucket are transported by boat. Occasionally, New Bedford concerns are called upon to make delivery on the other side of the bay, in Barnstable county. Once, at least, a Packard truck was sent around the bay, by way of Onset and Buzzards Bay to Falmouth, a distance of some 35 miles, with a load of lumber. This is a rare occurrence, however, and the main reason for this trip lay in the fact that less than a carload was required, making it possible for the New Bedford dealer to quote a price lower than what it would cost to purchase from a Boston house. Usually, New Bedford concerns are not called upon to make deliveries beyond a radius of 10 miles, although this is sometimes extended to 15.

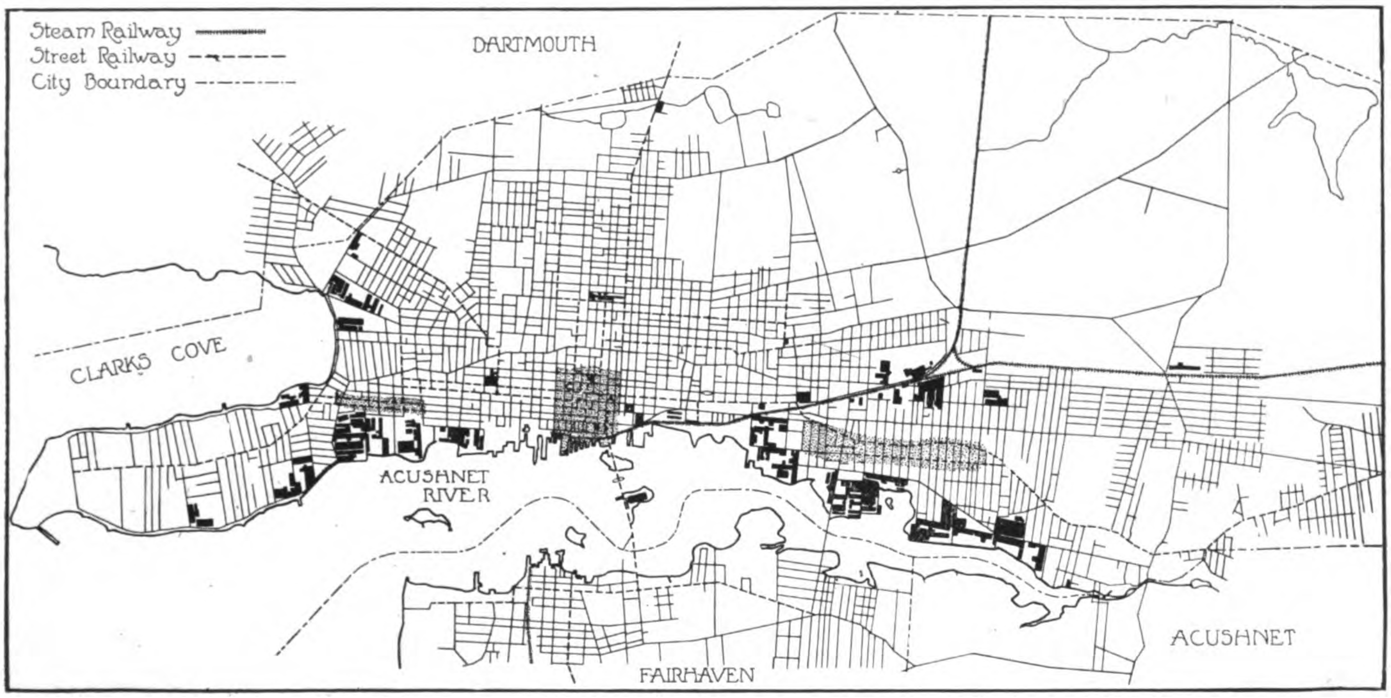
The Gas Meter Delivery Wagons; 1000-Pound Studebaker No. 2 and 1000-Pound Detroit No. 9.

These conditions have been described in some detail because of their important bearing upon the use of electric trucks and wagons. It was because of these conditions that the New Bedford Gas & Edison Light Company decided upon a promotive campaign. And while it was convinced of the possibilities, it determined to make such tests as should tend to prove its contentions and at the same time supply information of value in considering the final steps.

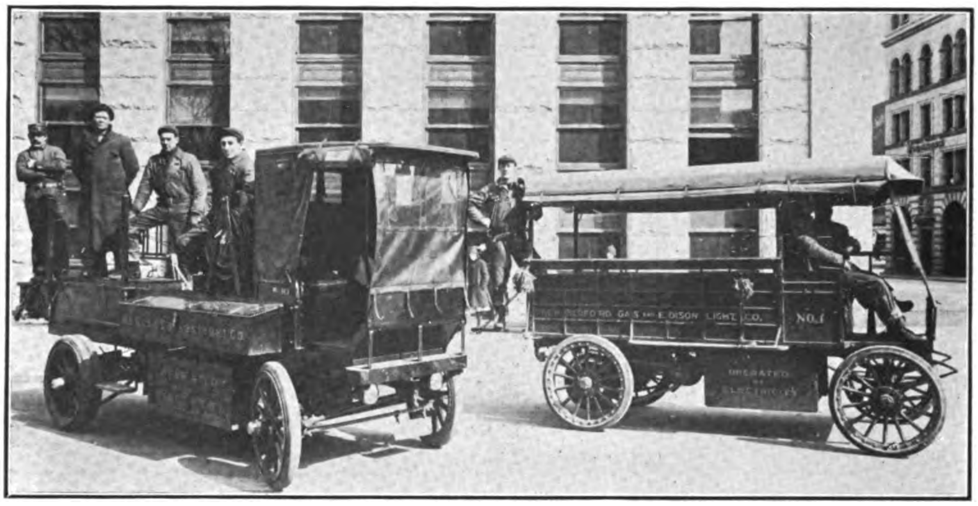
In October, 1909, the company purchased its first electric truck, a 2000-pound G. V., made by the General Vehicle Company, Long Island City, N. Y. This was followed in January, 1910, by a 1000-pound Studebaker, made by the Studebaker Corporation, South Bend, Ind. These two were continued in service until the spring of 1911, when two more G. V. machines, one of 1000 pounds capacity and the other of 7000, were added. In September, 1912, a 1000-pound Baker, made by the Baker Motor Vehicle Company, Cleveland, O., was purchased, and at the same time the company bought two electric runabouts, one a Baker and the other a Bailey, made by S. R. Bailey & Co., Amesbury, Mass. Two months later, in November, 1912, a 1000-pound Detroit, made by the Anderson Electric Car Company, Detroit, was added, and in December of that year a 4000-pound Baker.

It will be seen that the experiment, if such it may be termed, although in some respects the installation passed the experimental stage long ago, included a number of different makes, and machines of various carrying capacities. The results have been such as to afford the company some interesting and valuable data concerning the merits of the respective designs, a feature which may be turned to practical account when it is called upon later for advice regarding individual installations. It is hardly necessary to add that it does not care to make public its findings in this respect.

The ultimate object of the company is the maintenance of a service station for electric vehicles, both pleasure and commercial cars. Naturally, it expects to sell current, and it hopes, in addition, to provide that care and attention which shall insure the owner against failure or loss in any manner through the use of such vehicles. Plans are being prepared for this service station, which will be erected as an addition to the company's new office building at Purchase and Spring streets, in the heart of the city. These plans have not been sufficiently perfected to admit of dis-



Map of the City of New Bedford: Dotted Areas Indicate the Three Business Districts; New Bedford Gas & Edison Light Company's Present Office at A; Proposed New Building and Service Station at B; Present Garage for Electric Vehicles at C.



The Two Vehicles Used in Line Construction Work; One-Ton G. V. No. 1 and Two-Ton Baker No. 10.

cussion, but the structure will be about 67 by 100 feet. Just how much space will be devoted to storage, charging, etc., it is impossible to state, since there is no means of knowing, at this time, how much demand there will be for work of this character.

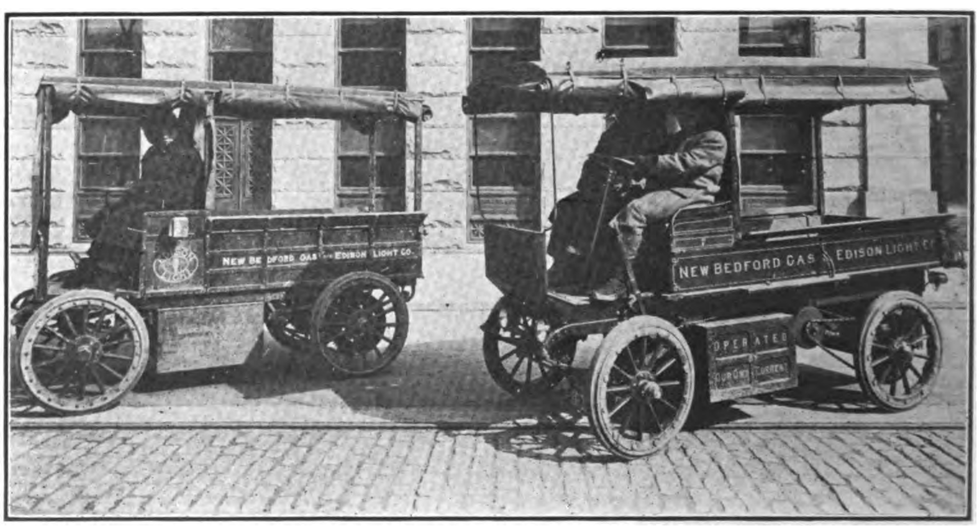
There are at present only two other electric wagons in use in New Bedford, these being of 750 and 1000 pounds capacity respectively, and something like a dozen electric pleasure cars. The building will not be ready for occupancy for some months, and it is hoped and expected that long before it is opened the number of such machines in service in New Bedford will be substantially increased. The campaign has reached the point where the company is prepared to offer facts and figures which it believes will carry conviction to the business man who is ready to consider the proposition. The company has no desire to take the agency for any make of machine, but it would welcome such agencies on the part of those already engaged in the automobile business in that city. It believes it is in a position to offer material aid to the dealer as well as the owner, and it is ready to talk business.

At present, the company's various departments are somewhat well distributed about the city. The main offices and salesrooms are on Middle street, near the corner of Purchase. Other offices are at the corner of Coffin and Water streets. The yards, shops, etc., are at the foot of Coffin street, on the water front. It is at this last named point that the trucks are garaged at present.

When the first machine was purchased it was placed in a wooden building adjoining the electric light station, at the foot of Coffin street. As the number increased, some of the space occupied by the horses was remodelled for this purpose. A shed was utilized, after it was reconstructed in a measure, for the charging panels, and one portion was reserved for a repair shop. This was only a small space in which work on the batteries might be done as occasion required.

The trucks and wagons are all known by number. The 2000-pound G. V. No. 1 is used in what is termed line construction work, this including the carrying of poles and wires, stringing wires, etc. The 1000-pound Studebaker No. 2 delivers gas meters and attends to the necessary work attendant upon setting these. The 1000-pound G. V. No. 3 delivers gas stoves and piping. The 3.5-ton G. V. No. 4 hauls coke and the large gas mains. The 1000-pound Baker No. 7 is used in the work of laying gas mains, carrying men, tools and small pipe. The 1000-pound Detroit No. 9 has the same service as that of the Studebaker No. 2—delivering gas meters, etc. The two-ton Baker No. 10 is another line men's truck, in service similar to that of the G. V. No. 1. The Baker runabout No. 6 is used as a foreman's wagon, and the Bailey roadster No. 8 as the electric superintendent's car.

Accurate account of the current consumed by these nine vehicles was kept for the six months ending June 30, 1913, with the results indicated in an accompanying table. These machines were charged every night, with the exception of No. 8, which was charged about every third night. No. 6 was given an occasional boost besides the regular charging. The voltage of the New Bedford current is 110, precluding the use of larger than a 42 or 44-cell battery. The average life of the batteries is placed at 15 months, although in some instances the experience of the company has been such as to indicate a little better than this.



The Half-Ton G. V. No. 3 Delivers Gas Stoves, While the 1000-Pound Baker No. 7 Helps to Lay Gas Mains.

TIRE COST A MILE FOR FOUR MACHINES.

Machine	Capacity pounds	Front	Rear	Cost a mile cents
G. V. No. 1	2000	36x4	36x4	2.56
Studebaker No. 2	1000	36x3	39x3½	1.65
G. V. No. 3	1000	36x3	36x3	1.50
G. V. No. 4	7000	36x6	36x5	5.08

The tabulation will prove of value to those who are considering the installation of electric vehicles, no matter where located, but, of course, the cost of current will be determined by the rate charged in any given locality. The experiment of this company has been with the added purpose of arriving at a decision with reference to this subject, and it has recently announced that it will be in a position to sell current for the charging of electric vehicles, providing current is not used between the hours of 4 and 8 in the afternoon, at the following rates: Up to 525 K.W.H., 3.5 cents a K.W.H.; 525-1225, three cents; 1225-2095, 2.5; 2095-4365, two; 4365-8730, 1.9.

In the matter of tires, the data thus far available with respect to the machines other than the first four are not held to cover sufficient time to be of value. Swinehart, Goodyear and Firestone tires are used, and the experience with the four machines cited has been such as to indicate a mileage cost as shown in an accompanying table.

Aside from the matter of tires and battery replacement, the expense for repairs has been very slight. Practically the only time lost has been due to the changing of tires. At first, it was impossible to secure provision for making such changes without sending the wheels to Boston. This work is now done at a local carriage factory. None of the trucks was out of service more than a day or so during the six months period mentioned above.

While the record of this installation is primarily of interest to the central station which is seeking an opportunity to develop this particular field, it will prove of decided value to the business man who is considering the advisability of making a change with reference to his transportation equipment. The results obtained, insofar as the company feels prepared to make them public, will serve as a basis upon which to compute the possibilities in any given locality.

RECORD OF INSTALLATION FOR SIX MONTHS, ENDING JUNE 30, 1913.

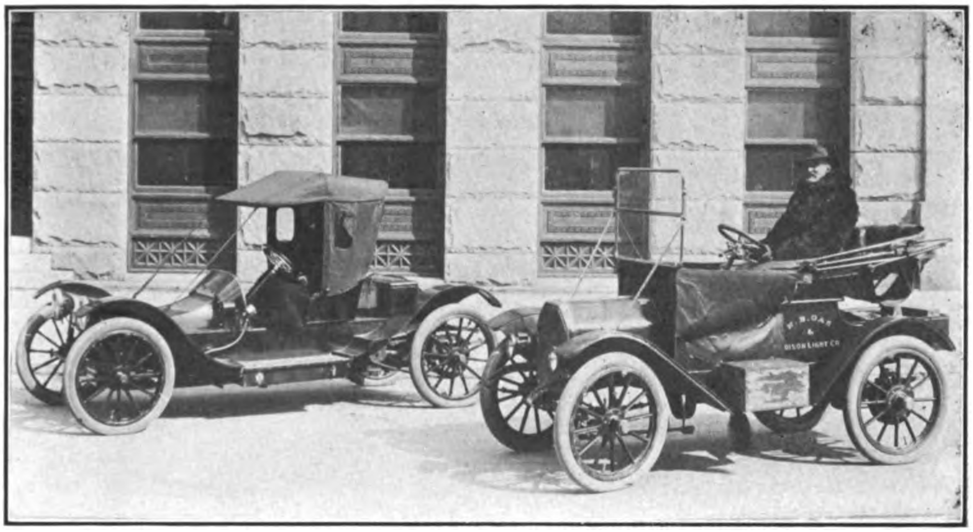
No.	Make	Capacity Pounds	Cells	Battery Make	Miles	K.W.H. a mile
1	G. V.	2000	44	National	2749	.787
2	Studebaker	1000	26	Ironclad-Exide	2225	1.200
3	G. V.	1000	44	Ironclad-Exide	3480	.655
4	G. V.	7000	44	Ironclad-Exide	1876	1.930
6	Baker	*	37	Ironclad-Exide	4775	.385
7	Baker	1000	42	Ironclad-Exide	3747	.493
8	Bailey	*	..	52 A6 Edison	2434	.672
9	Detroit	1000	..	60 A4 Edison	3521	.827
10	Baker	4000	42	Ironclad-Exide	1871	1.004

*Roadster.

BOSCH EQUIPMENT IN TESTS.

Made Good Showing in Connection with Recent Fire Chief's Convention.

The Bosch Magneto Company is authority for the statement that at the exhibition of apparatus at the Grand Central Palace, New York City, during the recent international convention of fire chiefs, of 30 different gasoline equipments shown 29 were fitted with Bosch ignition systems. During the 12-hour pumping trials in which 11 engines competed, seven finished the tests, and all of these had Bosch ignition systems and five of them used Bosch spark plugs. The Ahrens-Fox pump, which was operated continuously for 12 hours and during that time exceeded its pumpage rating, was equipped with Bosch ignition system and spark plugs.



Electric Superintendent's Bailey Roadster No. 8 and Foreman's Baker Runabout No. 6.

SIX SIZES OF KISSELKAR TRUCKS.

Now Producing Machines Ranging in Capacity from 1500 to 12,000 Pounds.

The Kissel Motor Car Company, Hartford, Wis., and Milwaukee, Wis., is now turning out six sizes of service wagons and trucks, these being of 1500, 2000, 3000, 5000, 7000 and 12,000 pounds. These machines are built with four-ratio transmission gearset, with a purpose of insuring maximum work under all operating conditions. The material used in construction is in every sense high grade, and the proportions are generous for every working part, while these are heat treated and hardened, and ample provision is made for lubrication and protection against wear. For these machines the maker claims that they will afford exceptional endurance and service.

BEE MADE VICE PRESIDENT.

Sales Manager of the Edison Storage Battery Company Given Promotion.

William G. Bee, for a number of years general sales manager of the Edison Storage Battery Company, Orange, N. J., and for 11 years connected with that company, has been made vice president of the corporation, a recognition of his success in marketing the Edison battery cell. Mr. Bee is one of the most active men in the motor vehicle industry, is a director of the Electric Vehicle Association of America and is very widely known, his activities being among manufacturers, distributors and users of all types of mechanically propelled machines, but especially with the electric vehicle men.

William G. Bee, Vice President and Sales Manager of the Edison Storage Battery Company.

Mr. Bee was associated with Col. A. L. Pope when the Columbia Bicycle Company was manufacturing Columbia electric vehicles at Hartford, Conn., about 1897, and he was given leave of absence while he served as chief gunner's mate on the United States steamer Gloucester, which was J. Pierpont Morgan's yacht Corsair, converted for naval use, during the Spanish war. After the war he returned to the Pope Manufacturing Company and was associated with Col. Pope, having charge of the Pope exhibit at the Pan-American Exposition. He also represented the company in Mexico for a year. Meantime the Electric Vehicle Company had purchased the Pope interests for manufacturing electric vehicles at Hartford, but the Pope-Waverley Company built electrics at Indianapolis, Ind.

HAULED 15-TON BOILER.

Demonstration of Capacity of Knox-Martin Tractor in Transportation Parade.

During a recent parade of motor vehicles in Philadelphia, Penn., one of the features was a Knox-Martin tractor hauling a trailer on which was carried a boiler that weighed 15 tons, this being more than double the weight on any other vehicle in the procession. The tractor hauled its load with no evidence of capacity being reached, and seemingly could have drawn a considerably greater burden.

The value of this demonstration was twofold, the first being the possibilities for all kinds of work with tractor and trailer equipment, so that with a change of bodies that may be quickly made material of great weight or large bulk may be carried with equal speed, and, second, that there is a very large economy of street area, a factor that is very important where the highways are congested with traffic.

The use of horse teams in large numbers necessarily means slower work, and the cost increases rapidly. While one would not consider tractor equipment unless there were sufficient service to insure its operation a large part of the time, the possibilities for the varying requirements of those engaged in heavy haulage are such as to justify careful consideration. In such work as this that the cost of maintenance is very small when not in actual use is an important factor.

KELLY IS SALES DIRECTOR.

Baker Motor Vehicle Company Recognizes His Work in Developing Business.

George H. Kelly, for two years manager of the truck department of the Baker Motor Vehicle Company, was, at a meeting of the directors on July 9, elected secretary and sales director, this being in recognition of his success in developing the division of the business directly under his control. During his experience as executive of the truck department the company's trucks have been placed in practically every desirable section of the United States, as well as in some of the principal cities of Europe, Africa, Japan, South America and Alaska.

George H. Kelly, Sales Director, the Baker Motor Vehicle Company.

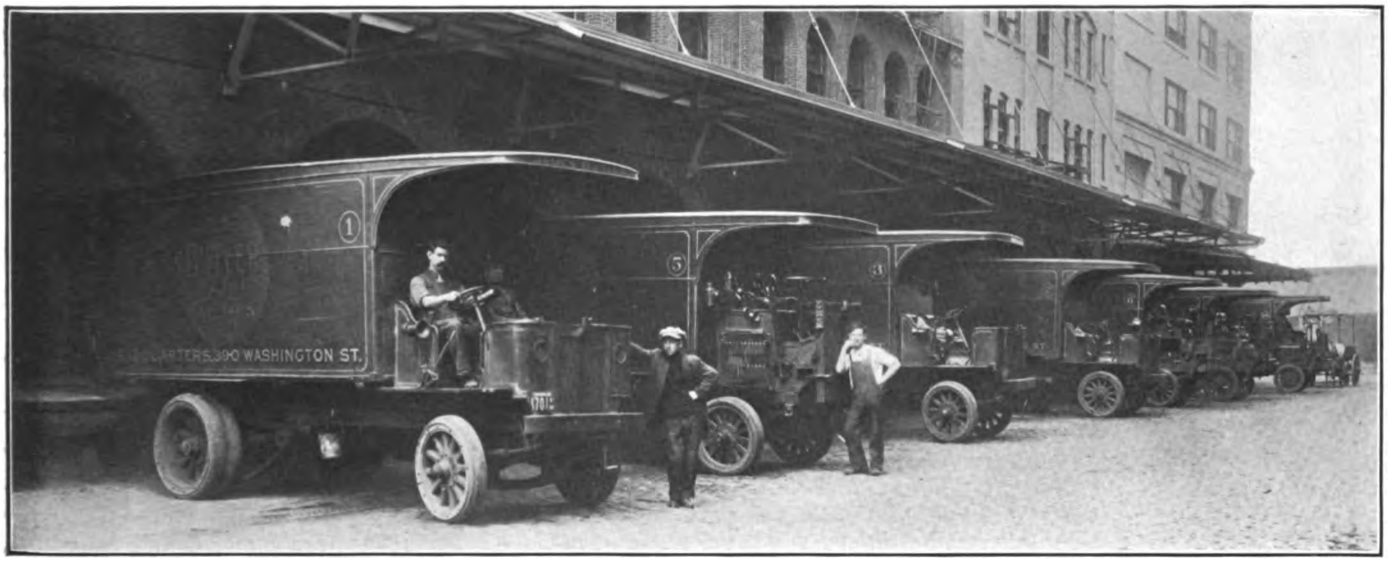
In the advancement of Mr. Kelly served as secretary were made in the personnel of other offices. R. C. Norton, who formerly served as secretary and treasurer, continues as treasurer of the company. E. J. Bartlett was made manager of the truck department and O. B. Henderson was continued as head of the pleasure car department. In making Mr. Kelly sales director the purpose of the company was to correlate the policies of the truck and pleasure car departments under one managing head, so that the co-operative work with dealers and customers might be brought closer together and be on a stronger basis.

TRUCKS CUT HAULAGE COST ONE HALF.

James Butler, Inc., Utilizes Machines in Stock Distribution to 250 Stores in Greater New York and Suburbs with Remarkable Economy from Common Sense Methods.

REDUCTION of haulage expense at least 50 per cent. by the use of motor trucks may appear to be an almost incredible statement, and that opinion would be justified in the mind of any man were it to be made by a person other than the business man who has realized this economy. Yet this has been the experience of James Butler, Inc., a business house that may be best described as "of New York and vicinity." The period covered by the use of motor vehicles is about five years, but during about half that time the work was done more or less experimentally.

James Butler, Inc., is probably the largest business of its kind in America that is concentrated in a comparatively small area. It maintains about 250 retail grocery stores in New York City and its suburbs, some being comparatively close to each other. Some are considerable distances apart. The precise location of these stores is probably known only to the office force and the shipping department of the warehouse, for were they all designated in advertising a considerable space would be necessary for addresses alone, and so the publicity usually specifies there are so many stores—Butler stores.



Line of G. M. C. Trucks at the Warehouse in Hubert Street, These Being All Five-Ton Machines and Used for the Distribution of Stock.

This business has been developed from a tiny corner grocery, and the Butler policy has been to deal direct with the people, the stores being located wherever the promise justified, and while many of these are of considerable size the purpose has been to have them within convenient distance and to develop what might be regarded as constant or family patronage rather than to expect custom from comparatively large distances. The number of stores has steadily increased, and when New York had been well provided for the suburbs were given attention. Now the resident of Long Island as far east as Huntington, the inhabitants of New Jersey as far as Orange, and the people of Westchester county in Yonkers, White Plains, Mount Vernon, New Rochelle, Mamaroneck and even Portchester, can find a Butler store close at hand.

In the early days of the Butler business the customers generally carried their purchases away. Delivery may have been discouraged, but as the stores began to multiply it was necessary to have the stocks replenished, which was done by buying from wholesalers who delivered to the stores. Later on a warehouse was established and buying was in considerable quantities, and from the warehouse the goods were distributed as required by the branches. It was easy enough to provide for the store delivery, for where one or two horses were required convenient stables made it possible to have horses and wagons in whatever number required. As a matter of fact the closer these were to the stores the better, but with the distribution of the supplies from the warehouse the problem was entirely different.

The main warehouse was located at Washington and Hubert streets, close to the railroad and shipping terminals, and from this the orders for stock were distributed by animals as far as they could be driven consistently, and beyond this the railroads were generally used. The number of stores has materially increased each year, but five years ago the business had reached such proportions that Mr. Butler decided that he would experiment with motor trucks, his first purchase being a Reliance three-ton machine.

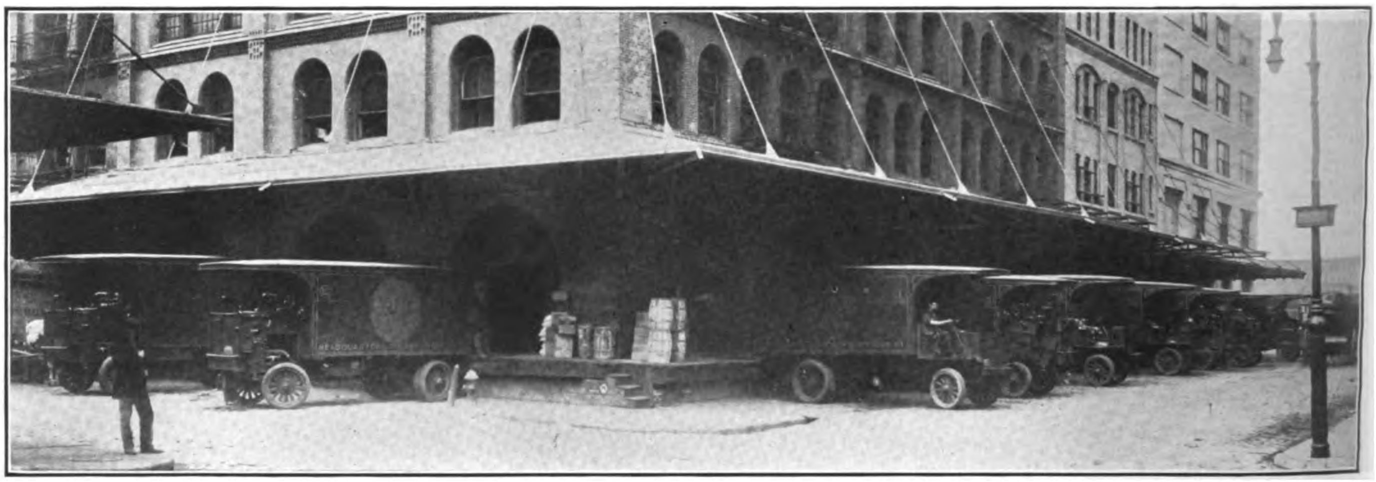
The theory of experiment was that the truck should be used for long hauls and the horses for shorter distances. If this use proved that the truck was econom-

ical for any specific work this could be studied. At that time the man who devoted his attention to haulage had but little information as compared with today. The work to be done was constant, to be sure, but it was always growing. The character of the business, however, was such that the accounting with reference to transportation was quite as definite as that of any other detail, and this experimental haulage was begun with the exact knowledge of cost of delivery and distribution. In this respect James Butler, Inc., was far in advance of the average firm, and it was this information, no doubt, that made possible the remarkable saving stated at the opening of this article.

It will be well for the moment to turn to the exact conditions with reference to haulage as they now exist. As may be assumed the volume of stock required for 250 or more stores is very large. The warehouse at Washington and Hubert streets is a big building. But this will house only supplies for a few days at most. Stock of all kinds is received daily at the different docks and railroad delivery stations, and it is transferred to the warehouse, but the warehouse was located with a view of minimizing this part of the haulage, and because it was central for distributing to all parts of New York and suburbs. With rare exceptions no stock is taken direct from the piers or terminals.

The different retail stores have one or more delivery wagons, but these are not considered in the traffic or distributing department. Each store is regarded as a separate establishment. It is under the direction of a manager who is responsible for its success, and the cost of delivery is kept in the accounting for each store. But the expense of distribution is charged against the business as a whole. In some instances the delivery wagons are kept at public stables; in others, stalls are hired in barns and the horses fed from supplies bought for the particular stores. Again, where the conditions will permit, there is a stable where a number of delivery wagons are grouped and the expense divided pro rata among the stores using the outfits. Some of these stables have as many as 20 horses in them, and wherever it is possible to group the delivery equipment of a half-dozen stores it is believed economical to do so. As the business now has in use something like 400 horses, the reader will understand that the delivery is a very large proposition, but each store manager handles his own service and economizes in whatever manner may appear desirable.

The main stable of James Butler, Inc., is now located at 222-228 West 68th street. This is a five-story brick structure, built for the purpose for which it is now used. The building is approximately five miles from the warehouse. Here were kept all of the horses and trucks used for distributing and a considerable number of the delivery wagons in the service of some of the retail stores. While the stable is a long distance from the warehouse, and theoretically it would have been best to have the stable for the distributing service close to the point where haulage is begun, that the delivery wagons of the retail stores could be provided for in large number was a fact that no doubt prompted the owner's decision to locate it where it is.



The Loading Platform at the Warehouse of James Butler, Inc., Washington and Hubert Streets, New York City, Extending the Entire Length of the Street Frontage.

At the time the first motor truck was bought the distribution to the stores was by two and four-horse teams and trucks. In addition to this all the stock received by freight by railroad or steamer was hauled to the warehouse by these same outfits. James Butler, Inc., bought high class horses and they were used humanely. While the hauls were long in many cases the animals were never overworked, and it may be said that for each pair of horses an extra animal was required to do the work. If a haul of unusual length were made the horses were given rest the next day; if used in hot weather or where the streets were obstructed by snow or where the footing was poor they were similarly relieved. That is, to secure constant service and to protect the investment in horses they were used with care and judgment. If the shipments were to be made to the distant suburban stores the stock was sent by freight wherever possible. It should not be understood that the horses were not used to their fullest capacity, but they were not abused.

When the truck was bought it was stored at the

stable in West 68th street. It was necessary to send it to the warehouse in the morning before beginning work for the day, but much of the time it could be driven into the stable without returning to the warehouse, so that there was comparatively little difference in mileage than were it kept near the central point for distribution. The experience with the truck justified the purchase of others, and these were Reliance machines. Later on a number of Garford wagons and trucks were bought, and still later a fleet of G. M. C. trucks was purchased. The motor equipment of the business is today 41 vehicles in all, of which 19 are G. M. C. five-ton trucks, five are Garford five-ton trucks, 10 are Garford one-ton wagons, one is a five-ton Reliance truck, and six are one-ton wagons, there being 25 five-ton trucks and 16 one-ton wagons.

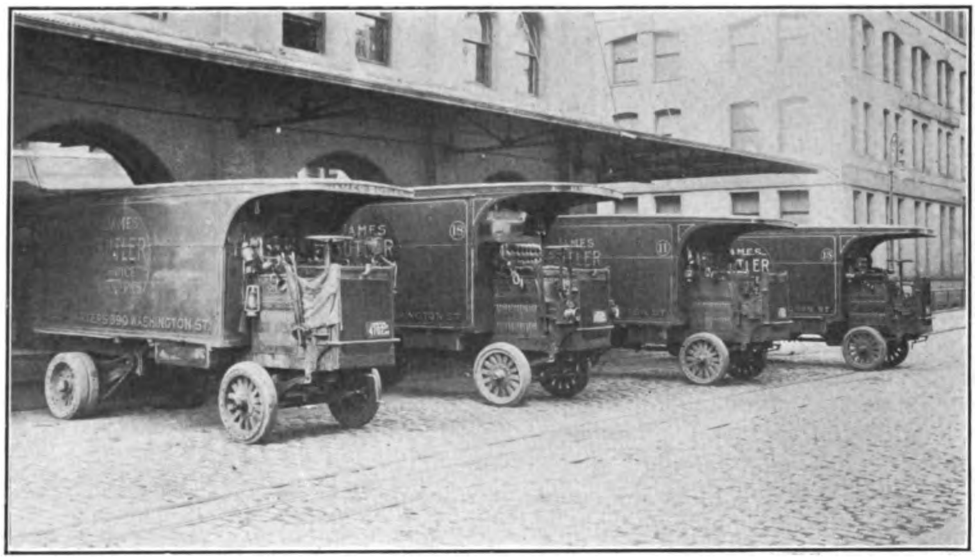
The five-story building in West 68th street is a combination stable and garage, the east section, divided from the stable by a heavy brick party wall, being used for the service station. The first floor is used for storing the machines, the second for storing the machines that are out of service for repairs, the third for storing machines that are ready for service after repairing, the fourth for an automobile repair shop, and the fifth for woodworking, painting and blacksmith shops. A large elevator carries the machines to the different floors.

The chassis only are bought and the bodies are built, painted and installed in the shops, for this is not only economical construction, but the bodies are constructed to designs that are found to best meet the requirements of the service. The repair shop is fully equipped with machine tools for doing all kinds of repair and reconstruction work, and there is every facility that five years' experience has shown to be necessary.

The five-ton trucks are used in distribution only, and the ton wagons are used for delivery from retail stores. The ton machines have been placed in service wherever the business appears to justify, and the results have been in every way satisfactory. The experience with the delivery vehicles does not warrant the assumption that eventually the entire store delivery equipment will be motorized, because it would seem hardly practical to handle motor wagons as horses are now handled with reference to storage and attention, though there is no doubt that a considerable number could be provided for in different garages convenient to the stores. It would not be possible, however, to have the care and maintenance under the direct supervision of the superintendent of the garage, which is undoubtedly a very large factor in the economical use of the machines that are now in service.

The regular distribution from the warehouse is made by 20 five-ton trucks. These are sent away from the garage at 6:15 each morning and the drivers report at the warehouse to the head of the traffic department, as the chief shipping clerk is known. Some of these machines are used solely for the haulage of fresh meats and others for groceries. The fresh meats are kept in cold storage at the warehouse and are cut to secure the qualities and weights best suited for the custom of the retail stores. The meat truck bodies are fitted with rear doors so that the contents are protected against dust and can be carried long distances without deterioration. Experience has shown that icing the meats, which was always necessary with horse vehicles, is unnecesary, and they can be delivered well chilled.

Loading platforms extend the full length of the warehouse in Washington and Hubert streets, and large doors give access to them. The orders from the



Group of G. M. C. Trucks, Showing the Types of Bodies Used for the Distribution of Groceries and Meats by James Butler, Inc.

store managers are received at the warehouse and are made up in piles on the main floor close to the doors. Each truck is sent out on a route determined by the head of the traffic department. The truck for a specified route has a regular station at the platform and on arrival it is backed to the station. Near this the goods for the stores are collected, each order separate. The orders are loaded on the trucks in reverse of the order of delivery, the driver and his helper doing the loading.

Each morning the 20 motor trucks and 10 two-horse trucks report to the warehouse at 7 or earlier. Generally the 10 horse trucks and half the motors are sent to different piers and railroad terminals, and as soon as these have been sent away the remaining 10 motor trucks, which are those having the longest routes, are stationed at the platform. As rapidly as possible these are loaded, this work requiring from an hour to an hour and a half, and while this is in progress the trucks sent for freight are arriving and unloading, the receiving necessitating the use of a great

deal of the platform. After the motor trucks have discharged the freights they are in turn loaded for the routes and sent away.

The average truck load is five tons, care being taken not to exceed the weight allowed, and as a rule the route will include from four to six stores, five being a fair average. As some trucks make two route trips a day this means that for them the number of stores to which delivery is made may be 10. Each store is given regular delivery of orders from the warehouse three times a week, so some machines will, or can, on the above basis, serve 20 stores, but this average is not maintained, for some routes are so long that but one trip is made a day, and in one instance but one delivery. With one or two exceptions all the stores are supplied by the trucks, and when there is time remaining after the distributing work the machines are utilized in hauling freight to the warehouse. As a rule the work is completed so that the trucks are back to the garage by 6 in the afternoon or thereabouts.

G. M. C. Truck at the Loading Platform in Hubert Street of the James Butler, Inc., Warehouse, Showing the Facilities for Quick Handling the Freight.

The 10 horse trucks are worked constantly on freight haulage, in many instances the hauls being very short; some for not more than three or four blocks, and where the greatest value of the motor truck is its speed it will be seen that their use would mean comparatively little gain in this work, and really a loss when the greater cost is considered. The longest freight hauls will rarely exceed a mile, and for these the motor trucks are used. In this part of the work they have a distinct value.

From the viewpoint of the traffic department of the business it is maintained that the 20 trucks used for distributing are at least the equal of 50 teams of horses, and this means two and four-horse outfits. Considering 10 four-horse and 40 two-horse teams this would mean that not less than 180 animals would be necessary to do this work, while there would not be by any means the same possibilities of suburban delivery. Previous to the use of trucks this delivery was made by freight, which necessitated haulage at either end, besides the expense of shipment.

There is another condition that is of considerable importance. At midnight during the season for fresh fruits and vegetables a buyer begins purchasing at the different piers and railroads, and several trucks follow him, collecting the purchases. These trucks are loaded and by 3 in the morning begin delivery trips, each covering a route. By 9 at the latest the trips are finished and the trucks return to the warehouse. In this manner it is possible to supply a very large number of the stores with the best stock procurable, but with horses only a small area could be covered and there would be more or less loss in hot weather. Throughout the year the stores are supplied with vegetables and fruit, and in extreme low temperatures no loss is experienced from freezing, so well are the loads protected and so quickly are the trips made.

So well is the organization administered that there is but little need of extra trips, for each store manager makes requisition and endeavors to make whatever replenishment is necessary before a stock is exhausted. Should there be need, however, the traffic department can make a special delivery, although the desire is to send out only fully loaded trucks. The longest run is to Huntington, L. I., and each day a truck carrying five tons makes a single trip, this store being about 40 miles from the warehouse. Adding the distance from the garage to the warehouse the mileage of this machine is close to 95. From the standpoint of the business it is more profitable to operate the truck for this work than to pay railroad freight. The average mileage of the trucks is approximately 40. This is about the distance covered by the delivery wagons. The drivers return to the garage between 3 and 7 in the evening, the fruit and vegetable trucks coming in first, and those on the regular routes from 5 on.

As each machine is driven into the garage it is seen by the foreman or the superintendent. Either of these men who may be on duty notes the truck or wagon as it is driven in. The first duty of the driver is to report the number of the machine, the time in hours and minutes it was out of the garage, the quantity of gasoline consumed in gallons, the oil used in quarts and the kerosene used in pints, the grease used in pounds, and the condition of the vehicle. These entries are made in a large loose leaf book by a clerk, and in ink. In this record is also entered the time the truck was in the garage, thus accounting for the entire 24 hours.

The night foreman examines this book and from it assigns men to do whatever work may be necessary. Should a condition be found that requires more work

than can be accomplished in a night the machine is withdrawn until it can be repaired. A stock of parts of all kinds is available, and with the repair facilities and men on duty nights a work of considerable proportions can be undertaken. Overhauling is done during the day and by a separate force of men than that engaged in repairing.

Assuming the case of the truck brought in in good condition: After the report has been made it is greased and oiled, the fuel, gas and water tanks filled, and it is washed. Whatever work of this character is done is shown in the time sheet of the men working on it. Thus there is a charge for labor and for supplies against this machine. If an adjustment is necessary the labor for this is charged. Should a repair be made the labor and the cost of the part or material is similarly recorded. The tires are examined and should there be need of attention or change the work is accounted for in the time sheet and the statement of material supplied.

The wheels of the truck are designated by position on the machine and by the number of the vehicle. The tire record shows the maker's serial number, the size, the position, the date installed, and the date of removal, and in addition the mileage driven. In the event of a tire change in the garage the labor is charged and the new tire entered, but if a wheel is damaged on the road a new wheel is put on, this being a distinct saving in time, and the wheel record will show this fact, for no further change is made, the wheel and tire being used until there is need of further replacement. It will be seen that the wheel record may vary somewhat from the actual mileage of the machine.

There is an emergency wagon kept at the garage in which are hand tools of all kinds, and in the case of accident whatever may be necessary in the way of parts is placed in the wagon and it is sent away. Should the repair be of such character that it can be handled on the road it is done by the mechanic in charge of the emergency wagon, but if it is a shop job a notification is sent to the driver of the nearest truck, who can always be reached by telephone in a short time, and he reports to the disabled machine, removes the load remaining and distributes it. The mechanic and the crew of the damaged vehicle do whatever work is necessary to return it to the garage.

Each truck is overhauled annually, and in rotation, sufficient time being taken to place it in first class condition, and while the mechanical work is progressing the body is given similar attention and painted. There is generally one machine under overhauling orders in the shop at all times. Each overhauled machine is thoroughly tested before delivery to the traffic department for use.

When trucks were first purchased drivers of experience with machines were hired, but the experience was that these men did nothing else than drive, and were not inclined to do more handling of the load than was possible. Not only this, they wanted to drive at maximum speed and had little sense of responsibility. Then the method of administration was changed. Men were trained as drivers and were not trusted with trucks until the superintendent was confident of their competency. They were first employed as helpers and after being taught to drive were allowed to drive with different men who made report on their ability. One man finally decided whether or not they were capable. If a man promised to become competent with more training he was allowed to obtain more experience, the policy of the superintendent being to get good men and to help them in every way if found worthy.

Each driver who is placed in charge of a truck or wagon is first credited with the machine. An exact record is made of its condition. Each day against this vehicle the cost of gasoline, oil, kerosene, grease, washing, cleaning, adjusting, repairing, labor or material of any kind, is charged, and in addition tires as installed or repaired, wages, and the pro rata of the overhead, which includes insurance, rent, depreciation, lighting, heating, water and the necessary clerical work. From this record it is possible to ascertain the precise expense of operation, maintenance, attention and investment, by the day, week, month or year, or for the period that any man may be in charge. The driver is responsible for so much property and for its economical use. Upon his ability to use the machine economically depends the wage he receives. The man who can do his work at the least expense is regarded as the better man, no other factor being considered. The men are paid according to the showing that is made in the financial account of the machine. Excellent wages are earned by these men and they are assured of employment so long as they can keep their trucks up to the standard and within the expense limit, but those who can show the lowest cost have the greatest earning capacity. This policy is to make each driver manager of his truck, just as the stores are managed, and to expect him to make the greatest profit that is possible with it, although there is, naturally, a limit to what can be accomplished. The men are given encouragement to do their best, and there is a great deal of rivalry between them as to who will do the best work. The policy has not brought about neglect of conditions that might cause deterioration through the desire to do work as long as possible without attention, for the system of inspection insures against this, and the men realize that in the end, through repairs or overhauling, they would fare badly.

The economy of 50 per cent. or more in the store distribution expense is not an estimate. When horses were used exclusively the accounting was absolutely accurate, and much attention was given to handling the freight with least expense. The loading platform at the warehouse was built to economize delivery and dispatch stock, and there has been no need of change since motor trucks were installed. The saving had been made through the superior capacity, speed and larger radius of movement of the machines, and the system that places the responsibility upon the drivers.

MINIMIZING BEARING FRICTION.

By W. H. Stillwell, M. E.

THE electrically propelled vehicle is probably the best example of concentrated design that is in general use today. Due to the fact that all of the power must be obtained from a storage battery of limited capacity, the distance travelled depends not only upon the amount of power available, but upon the percentage of this amount that can be converted into tractive effort. The elimination of all unnecessary weight in the car and the reduction of friction and electrical losses are about the only ways of increasing the mileage for a given battery and motor power.

The use of alloy steels and light weight bodies has reduced the car weight almost to the limit. Since there seems to be no good way of reducing the weight of battery and motor, and no way of reducing the electrical losses, most of the manufacturers have turned their attention to the reduction of friction losses. The shaft drive car has helped a great deal, and a few are now changing to worm drive to obtain a further reduction.

Needless to say, the bearing friction is the most important of all of the mechanical losses and the highest type of anti-friction bearing is required. The annular ball bearing has been universally adopted on account of its having the lowest friction coefficient of any type now on the market. There is of course a vast difference in ball bearings, and their anti-friction qualities. The high polish of balls and raceways and the accurate assembly of the bearing are the two main features, although the separator friction and the energy required to revolve the separator with the balls also has quite an appreciable effect. Any bearing having uniformly hardened steel, highly polished, uniformly hardened balls accurate to .0001 inch, highly polished raceways of a radius equal to approximately .6 of the ball diameter, and a light weight separator touching the balls at one point only should give a minimum friction loss.

Annular ball bearings now on the market also vary considerably in their load capacity. Primarily, of course, this factor is determined by the elastic limit, and the method of hardening the steel. Assuming that these qualities, and the accuracy of assembling are equal, the load capacity will then only vary with the form of raceway and the number and diameter of balls in the bearing. The load capacity and the friction loss of a given ball is greatest when the diameter of raceway is equal to the ball diameter. The load capacity and friction loss is smallest when the raceway is a plane tangent to the ball; since a minimum of friction with a maximum of load capacity is required, a compromise between these limits is necessary. Many experiments have determined a correct radius of curvature which is approximately .6 of the ball diameter, and this figure has been adopted by all of the leading manufacturers as standard.

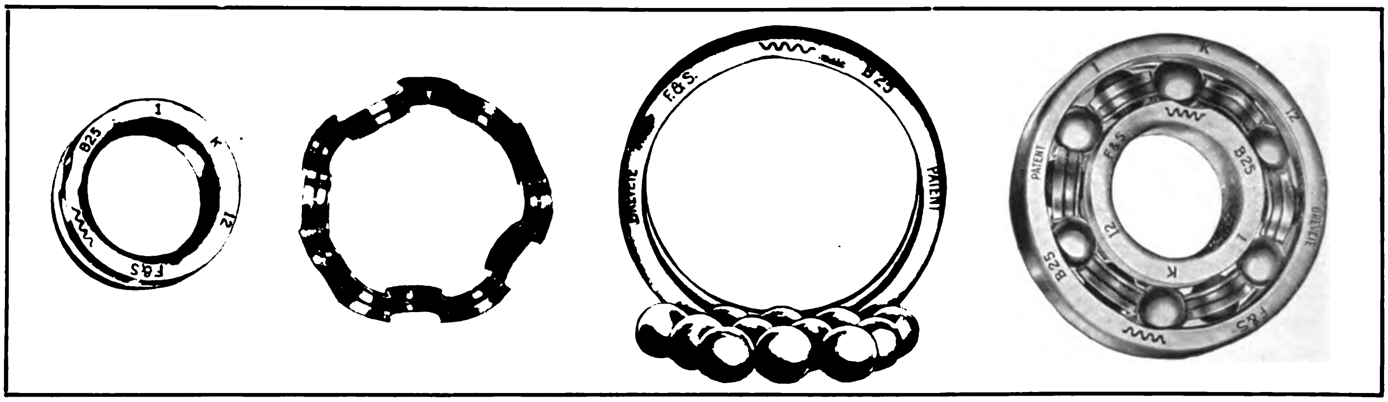
Assuming all of the previously mentioned conditions as being equal, the load capacity will vary directly with the number of balls and directly as the square of the ball diameter with corrections for the load distribution and a constant which may vary for different forms of raceways, speeds and grades of steel. Mathematically expressed the formula reads as follows:

$$P_{kg} = .24 \times K \times N \times d2$$

Where N = number of balls, d = ball diameter in eighths of an inch (i. e., diameter = 1 inch, d = 8, diameter = 5-16, d = 2.5), K a constant whose value has been obtained from a long series of tests, and .24 is the percentage of balls subject to load at a given instant. As before stated, the value of K varies with the speed. The following values are used by Messrs. Fichtel & Sachs, makers of the F. & S. bearing, and are considered quite conservative:

17— 50 R. P. M.	15— 200 R. P. M.	13— 500 R. P. M.
11— 800 R. P. M.	10—1000 R. P. M.	8.0—1500 R. P. M.
6.5—2000 R. P. M.	5.5—3000 R. P. M.	

This bearing, which is shown in the accompanying cut, has the largest load capacity of any bearing now on the market, due to the number and size of balls used. The accuracy of workmanship, separator design and high quality of steel have made it the standard of quality throughout the trade.



The F & S Ball Bearing and Its Components: From Left to Right, Centre or Shaft Collar, Separator, Ball Race and Balls and the Assembled Bearing.

AGRICULTURAL MOTOR TRIALS IN FRANCE.

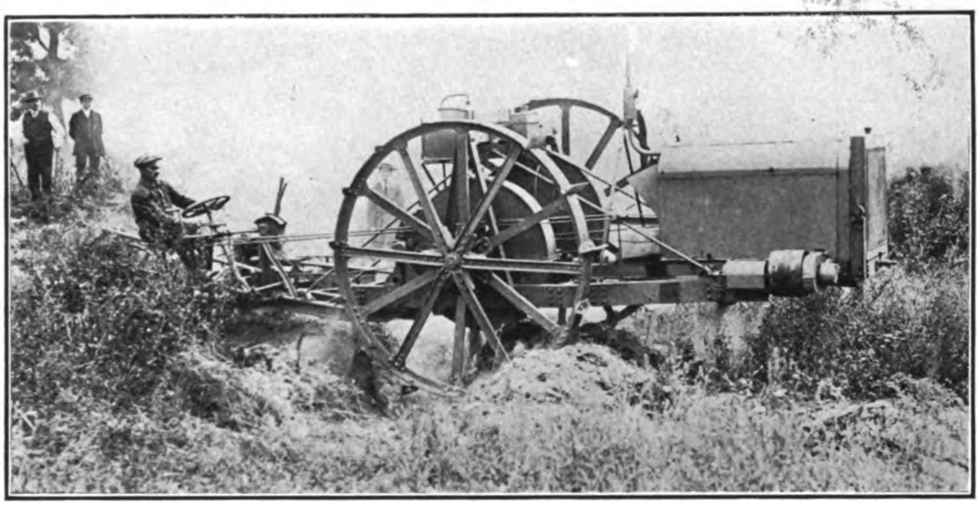
Some Interesting Designs Revealed by Second International Exhibition and Congress at Soissons---Importance Attached to Machines Suitable for Small Farms.

PERHAPS the most important test of its kind was that conducted under the auspices of the Association Francois de Motoculture, in connection with the recent second international agricultural motor congress at Soissons, France. The list of delegates attending the congress included representatives of the government, colonial and agricultural organizations in Belgium, Spain, Sweden, Greece, Egypt, Brazil, South Africa and Tunis, indicating the importance in which this phase of the industry is held in the several countries. It may be added that the French farmers appear to be eager to consider the claims of agricultural motors, largely because of their bearing upon the difficulty of securing laborers, and the possibility of securing machines which will render them somewhat independent in this respect. The same conditions apply in some of the other countries represented at the conference and were reflected in the machines on display.

In addition to the exhibition of machines for practically all kinds of farm work, some little time was devoted to an actual test under working conditions. A tabulated result of these trials is not available at this writing. It may be stated, however, that the results were in no way comparable to those that have been obtained from the agricultural trials held annually at Winnipeg, Can., for the reason that in this instance, more attention was devoted to the machines designed for light work; machines capable of plowing up to three furrows, rather than those powerful tractors employed on the large tracts in the United States and Canada. Plows, hoes, planters, reapers and mowing machines were represented, but a substantial majority of these were designed for use on the so-called small farm.

America was represented in the trials by the Holt Caterpillar tractor, made by the Holt Manufacturing Company, Stockton, Cal., this being exhibited by Jules Schnerb of Antwerp, the Continental distributor. This machine is not new in this country, having been used with much success on the western plains and in Canada, as well as in what might be regarded as smaller installations. Instead of the usual traction wheels, a chain mechanism is utilized to deposit a series of plates, from which arrangement the vehicle derives its name, so as to provide increased contact with the ground for travelling over soft and uneven surfaces.

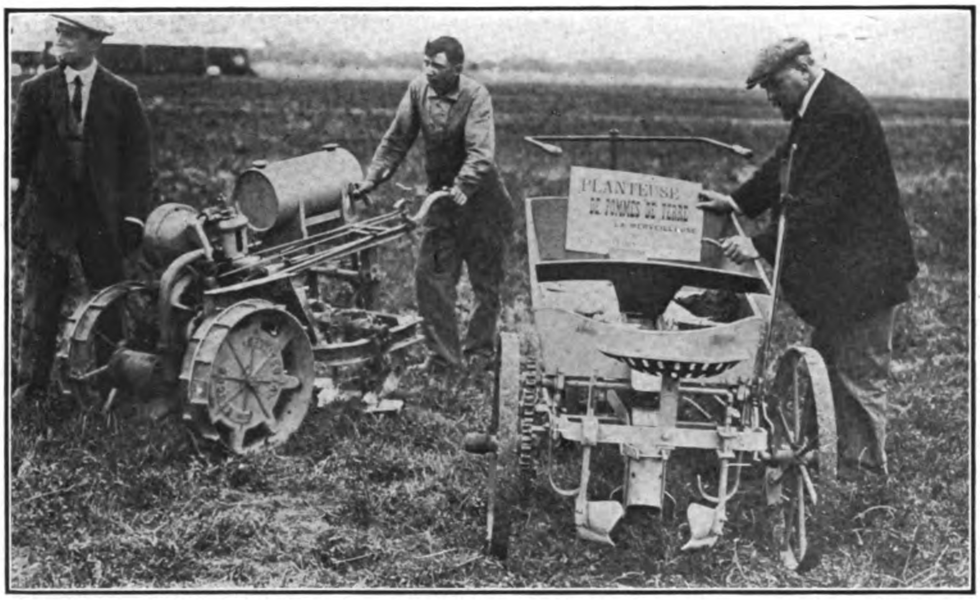
The Stock motor plow, shown by the maker, the Stock Motorflug, Ltd., Berlin, Germany, is self-contained, by which is meant that the plowing attachment is connected permanently to the frame of the vehicle instead of being hauled by the latter as a separate implement. Two driving wheels of large diameter, fitted with deep paddles to increase their grip upon the soil, are mounted at the centre of the frame, which is supported from the main axle and practically is balanced in a horizontal position. The motor, which with the radiator is carried at the extreme forward end, is rated at 42-50 horsepower, and is equipped with Bosch ignition and a carburetor designed to operate on gasoline, benzol or other similar fuels. Power is transmitted through a clutch and change speed gearing, and finally by spur gears meshing with large diameter gears on the main axle. Steering is by means of a hand wheel and irreversible gearing, which controls the movements of the single wheel pivoted at the rear and on the left side of the plowboard, which is arranged to accommodate six bottoms. This rear wheel is provided with a central flange to prevent side slipping and the steering movements are communicated to it through a long diagonal rod fitted with the usual type of ball joints. The end of the plow frame is raised or lowered by means of a rack and pinion gear operated by a long endless chain taken from a sprocket on the end of the horizontal shaft fitted with a handle in front of the driver, thus enabling one man to drive the machine and attend to the six plows. It is understood that over 700 machines of this type have been supplied by the maker for use in Germany and elsewhere.



Stock Self-Contained Motor Plow, Working in Rough Land at Soissons, France.

Vve. A. de Mesmay, Saint Quentin, France, was represented by two vehicles, one a tractor capable of hauling two plows, and the other a hoeing machine. These more nearly approach the type which is de-

signed to replace a pair of horses on the smaller farm. The tractor is mounted on four wheels, all of which are driving members, and is propelled by a two-cylinder, 15 horsepower Abeille motor located at the rear of the chassis frame and trussed on both sides by channels. Power is transmitted forward to a cone clutch, and thence by a short shaft to a gearbox under the driver's seat. A short shaft and bevel gearing transmit the power from the gearbox to a vertical shaft, at the lower end of which a bevel pinion and crown wheel deliver it to the forward wheels. The shaft and gearing are contained in a strong casing between the wheels, which for steering purposes are made to swing together by means of a bevel gearing encased and mounted at the extreme front of the frame, and controlled from the driver's seat by a steering wheel and sloping pillar. For driving the back wheels, a long shaft is taken from the gearbox, below the engine, and terminating with a worm which engages with the underside of a worm wheel on the rear axle. The drawbar is attached to bearings on this axle.



The Larger Bauche Hoeing Machine and a New Automatic Potato Planter.

The de Mesmay hoeing machine is somewhat similar in design, although its front wheels only are driven, in the manner explained above. The motor is a single-cylinder Abeille, rated at seven horsepower. Two seats are provided, one in front for the driver, and the other behind for the man who manipulates the hoes. These latter are 18 in number, fixed to a transverse shaft supported below the chassis, and raised or lowered by means of a hand lever.

The vehicles displayed by Eugene Bauche et Cie, Le Chesnay, France, were three in number, each designed to take the place of a single horse. Two of these were hoeing machines and the third a mower. All are controlled by the driver walking behind instead of riding, and all are said to have proven practical in a large number of installations.

The larger hoeing machine is propelled by a single-cylinder, four horsepower motor, driving the two main wheels in front. The engine is air-cooled by means of a rapidly rotating fan, so encased as to deflect the currents of air around the cylinder. The final transmission is by means of pinions and internally cut gear rings, and the whole of the transmission mechanism is encased and protected from dust and dirt. The rear of the machine is carried on a single trailing wheel, and between this and the engine are two transverse shafts, to which are attached the four hoes. By means of an eccentric and rod these are given a reciprocating or striking action when the machine is in motion. The smaller hoeing machine is similar in every respect, with the exception that its engine develops but 2.75 horsepower.

The Bauche mower has a single-cylinder motor rated at three horsepower, placed with its crankshaft parallel to the main axle. The drive is taken by means of spur gearing to a shaft on the right of the engine and carrying the clutch, which when engaged transmits the power to the right hand main wheel by spur gearing. By means of other spur gearing, the left hand wheel is made to drive a pair of bevels which rotate a shaft leading forward and terminating with a disc and crankpin, to which a rod is connected and made to actuate the usual form of cutter bar arranged at the extreme right of the vehicle. This cutter bar is hinged so that it may be elevated to a vertical position when not in use. The machine is guided by a pole at the rear, fitted with two handles between which is fixed a hand lever for operating the clutch. In front a simple form of mechanism permits the cutter bar to be raised or lowered as required.

Shown in connection with the Bauche machines was a potato planter, and while definite information is lacking as to the motive power for this, it is assumed that provision is made for attaching this to one of the other vehicles. The operator of the planter has a seat at the rear, handles in front to guide the machine and a lever at the right to actuate the mechanism arranged to drop the potatoes at stated intervals. Directly in front of the distributing tube is a plowshare, which digs the necessary drill, and immediately behind the tube are two hoes, so arranged that the potato is covered automatically.

A number of French makers have devoted attention to cable systems of plowing, in which the tractor is fitted with winding drums by means of which the plow is drawn across the field, or by an arrangement of pulleys the vehicle winds itself back and forth by means of a fixed cable drawing the plow behind it.

Georges Filtz, Juvisy, France, exhibited one of his Arion tractors and two cable trucks, to which the ends of the cable are attached when stretched across the field. Each truck is provided with a small drum, rotated by a handle and ratchet gear. When engaged in plowing, cables are taken from these drums and anchored some way down the sides of the field, and after each furrow has been plowed the trucks with the connecting cable can be moved by slightly rotating the drums by means of the ratchet gear.

The Arion tractor is a four-wheeled vehicle, fitted with a four-cylinder, 40 horsepower motor, driving through a clutch to a special gearbox, which transmits the power to one of two large cable pulleys carried in line with each other on one side of the frame. The plowing cable is first passed through a roller guide, mounted on one end of the tractor frame, three times around the two pulleys in the form of a figure eight, and then through another roller guide at the other end of the chassis. By this means the tractor is made to travel in either direction, and to draw the plow or other cultivating implement. A form of balance plow is utilized, so as to save time when reversing the direction of the headlands.

Another interesting and somewhat similar system is represented by the machine shown by Delieuvin et Cie, 77 Avenue de la Grand Armee, Paris, although in this case the plow only is drawn across the field. Two vehicles of exactly similar design are employed. The chassis is mounted on four large diameter wheels and carries a 10 horsepower De Dion-Bouton motor, from which power is transmitted by belt to fast and loose pulleys on a transverse shaft directly above one of the axles. This shaft is fitted with a spur pinion engaged with a spur wheel attached to a cable drum of large diameter. The cable of this drum is taken around an idle horizontal pulley, carried in the centre of the vehicle, below the frame, and about 18 inches from the ground. The vehicles are placed opposite each other, one on either side of the field to be plowed, and the cables are attached to either end of a form of balance plow, which is drawn in alternate directions across the field by means of the winding drums. As exhibited, shafts are provided and a horse is required to haul each winding vehicle down the field after each line of furrows has been plowed, although, doubtless, some method will be found to utilize the power of the motor for this purpose.

This by no means exhausts the list of agricultural motor vehicles exhibited and tested, but it suffices to indicate the various types presented. MOTOR TRUCK is indebted to Motor Traction of England for much of the descriptive matter contained herein.

GENERAL NEWS FROM ABROAD.

Lord Mayor Designs Body—In order to provide a double-decked motor 'bus which shall afford protection from the weather for the occupants of both decks, the Lord Mayor of Vienna, Austria, has designed a body of this type, which is meeting with general satisfaction in Europe. The interior seating arrangement also has been given consideration, the passengers being disposed somewhat in the form of two semi-circles, placed side by side.

Australian Motor 'Bus Company—The Melbourne Motor Omnibus Company, Ltd., has been organized with office at 352 Collins street, Melbourne, Australia, to operate a fleet of motor 'buses in that district.

Good Road in Nigeria—According to the African World, an attempt is soon to be made to establish a regular service of motor vehicles between Kano and Katsena in Nigeria, Africa, a metalled road 95 miles in length having recently been constructed.

French Subsidy Awards—Official announcement from the French minister of war shows that the following vehicles successfully passed the recent tests for subsidy awards: Delahaye, with four vehicles of one type; Latil, with four vehicles, representing one truck and a four-wheel driven tractor; Saurer, with two vehicles of two types; Berliet, eight machines of four types; Panhard et Levassor, De Dion-Bouton, Delaugere et Clayette, Brasier, La Buire, Peugeot and Aries, each with two machines of one type. This year's trials brought together 72 machines, of which 68 finished and 38 were awarded subsidies.

Bauche Mowing Machine, Utilizing Single-Cylinder Motor.

Commercar Supersedes Coach—Despite the sentiment attaching to the old time stage coach, which has operated between Campbelltown and Tarbert, Scotland, for over 40 years with but one failure to complete its daily journey in that time, this has now been superseded by a service of Commercar motor 'buses.

Fire Engines in Japan—In reply to an expert attached to the German consulate at Yokohama, Japan, who suggested that makers of motor driven fire engines might find a good market in that country, an English engineer states that the narrowness of the streets and their labyrinthine character preclude the universal application of such vehicles as are produced

in Great Britain, for instance. He adds that in order to have any chance of success, such machines must have the flexibility of the two-wheel, coolie drawn cart, and the motor must deal with a suction depth of say 17 feet and pump water through a hose 49-62 feet to a distance of 98-131 feet and to a height of 39-49 feet.

New Customs Regulations—Under the South African Union customs management act of 1913, it is provided that invoices for goods shipped to South Africa must contain, in addition to the invoice value, a statement of the "current value for home consumption in the open market for similar goods at the place of purchase."

Motor Service in Ireland—Sir Henry Grattan Bellew is chairman of the committee representing merchants in the Mount Bellew district of Ireland, for the organization of a company to operate a fleet of motor vehicles for passengers and freight in North-East Galway. The expense and delay of the present railway facilities is responsible for the movement.

French Export Statistics—The official figures for the exportation of commercial motor vehicles from France during the first half of 1913 show a total value of such exports of about $2,000,000, as compared with about $625,000 for the corresponding period in 1912. Belgium is the principal market, followed by Germany, Brazil and Argentina. The exports to Turkey and Switzerland indicate a decrease.

South Australian Farm Wagons—It would appear from recent advices from South Australia that there was a profitable field to be worked among the farms in that section. In the vicinity of Mount Lofty three enterprising farmers recently have purchased machines with which they transport their produce to market. When not busy in their own work these men find abundant opportunity to haul produce for their neighbors.

French Army Competition—The French war office has given notice of a competitive test of four-wheel driven machines early in February, 1914. The vehicles must be of French manufacture and constructed according to details already furnished the makers. It is understood that the producers of the Latil, Chatillon-Panhard, Balachowski et Caire, Schneider, Renault and Crochat will take part.

Truck Show in Paris—While the annual Paris Automobile Salon in the Grand Palais will be devoted entirely to a display of pleasure vehicles, the management of the show has taken cognizance of the growing interest in commercial cars, and a special building will be erected in the Cours la Reine, where such machines will be exhibited, Oct. 17-27, during the progress of the annual showing in the Grand Palais.

THIRTY-EIGHT CENTS A TON.

That Is What It Costs Battle Creek Concern to Haul Its City Freight.

Believing that the general public would be interested in its experience with a three-ton motor truck in hauling city freight, the transportation superintendent of the Kellogg Toasted Corn Flake Company, Battle Creek, Mich., has issued a statement, in which the name of the vehicle has been eliminated purposely. The object in this instance has been to present figures that could not by any means be traceable to the manufacturer of the truck.

During the three years this machine has been in service it has averaged one set of tires a year, and the repair bills in that time have totalled less than $50. No charge has been made for depreciation, the superintendent maintaining that the truck still is in efficient condition. The machine is utilized in carting freight between the factory and the freight depots in Battle Creek, and for the delivery of less-than-carload lots in the city and immediate vicinity.

The figures for the month from July 7 to Aug. 5 show that 259.3 tons of freight were handled at a cost of 38 cents a ton. These figures include charges of $78 for labor, $18.72 for gasoline and $2.14 for oil. The record of the truck's performance for this period follows:

July—	Gallons gasoline.	Oil	Freight hauled, pounds.
7	5	1 quart	22,725
8	4	1 quart	22,790
9	5	1 quart	23,452
10	5	1 quart	18,318
11	5	1 quart	19,661
12	4	1 quart	15,344
14	4	1 quart	23,685
15	5	1.5 pints	27,645
16	5	1.5 pints	16,147
17	5	1.5 pints	17,910
18	5	1 quart	19,060
19	3	1 pint	10,418
21	4	1.5 pints	22,150
22	6	1 quart	28,006
23	5	1 quart	20,009
24	4	1.5 pints	22,127
25	4	1.5 pints	20,352
26	4	1.5 pints	16,595
28	6	1 quart	30,207
29	3	1 pint	11,168
30	3	1 pint	6,508
31	5	1 quart	19,572
August—			
1	5	1.5 pints	18,285
2	6	1 quart	27,746
4	4	1.5 pints	20,863
5	3	1.5 pints	17,886
Total	117	21.5 quarts	518,629

The Kaufmann-Bear Company, which has established a new department store at Pittsburg, Penn., has placed an order with the White Company, Cleveland, O., for 38 wagons and trucks of different capacities, and is to supplement this with 20 additional machines later on. The initial order of 38, however, is to be delivered as quickly as is practical. When these machines shall be delivered there will be a total of more than 160 White vehicles in service in Pittsburg.

Municipal Service Equipment

BROWN FUNERAL CAR.

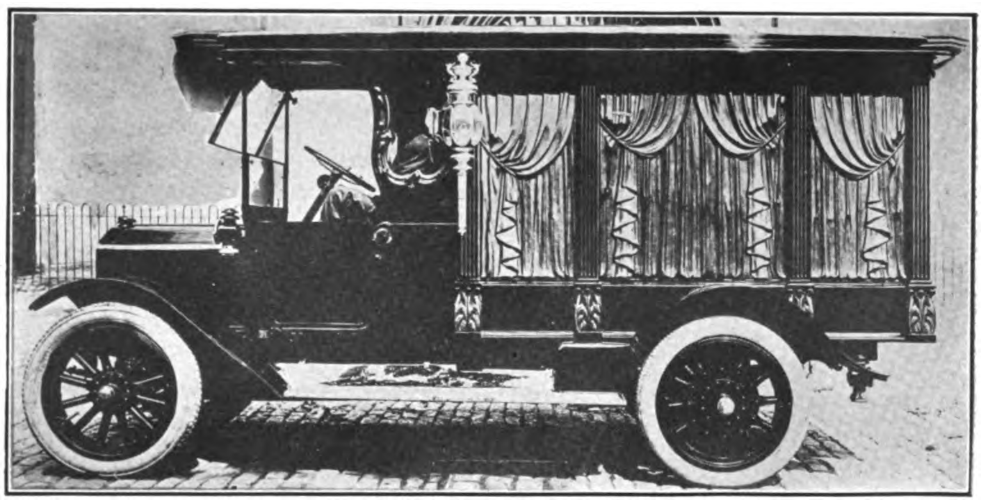
Indiana Manufacturer Finds Demand for This Product Is Increasing.

Something like a year ago, at the annual convention of funeral directors in the Middle West, action was taken looking toward a more general adoption of the motor vehicle. At that time the delegates to the convention were not prepared to state definitely that motor driven hearses would entirely supersede those drawn by horses, but it was the consensus of opinion that it was wise to give the subject deliberate consideration. Of course, motor driven casket wagons have been in service in all sections of the country for some time.

An accompanying illustration presents a funeral car—a name which appears to have entirely superseded the older term with the appearance of the newer type of vehicle—made by the Brown Commercial Car Company, Peru, Ind., for A. Geissel & Sons, a funeral director in Philadelphia. The chassis is standard, but it will be noted that it is mounted on pneumatic tires, and other provisions made for easy riding qualities. The appointments are quite as ornate as with the horse drawn vehicle, and in every respect there appears to have been a careful consideration by the designer of the use to which it will be put.

This car took part in the recent motor truck parade in Philadelphia and attracted much favorable comment. Will H. Brown, president of the company, who recently returned to the factory from a visit to New York City, announces that he has orders on hand for several of these vehicles for delivery in the East.

Another new Brown vehicle is illustrated herewith, this being a combination chemical engine and fire wagon. Mounted on a light weight chassis, this is designed for use where it is desirable to have a fast machine available for answering alarms. The equipment is such as to take care of incipient brazes before they have reached serious proportions.



Brown Funeral Car Recently Delivered to an Undertaking Concern in Philadelphia.

AMBULANCE A LIFE SAVER.

Worcester Surgeon Gives Abundant Evidence to Substantiate This Claim.

That the ambulance in service with the police department in Worcester, Mass., is a life saver, seems to be abundantly proved by the testimony of Police Surgeon Richard J. Shannahan. This is a phase of the situation which is not always given the consideration it merits, when city officials are estimating the probable cost of new apparatus. Dr. Shannahan says:

Only the other day we had a case of asphyxiation and to the police automobile ambulance can be laid the fact that the man's life was saved. We went out on the call before discovering the necessity for the pulmotor, and had we been compelled to wait for a horse drawn vehicle to bring it, so much time would have been taken up that the man would have been dead long before it arrived.

This is only one of a dozen such cases we have had recently. We had a drowning accident in Quinsigamond last week, and if we had not had a fast car the child who figured in the accident would have been dead when we got there. As it is, the child is as well as ever. We can make the trip to the lake from station 1 in four minutes. One night recently we made the trip to the lake, spent five minutes in attending to the patient, took him to the city hospital and was back in the station in 20 minutes from the time we left it.

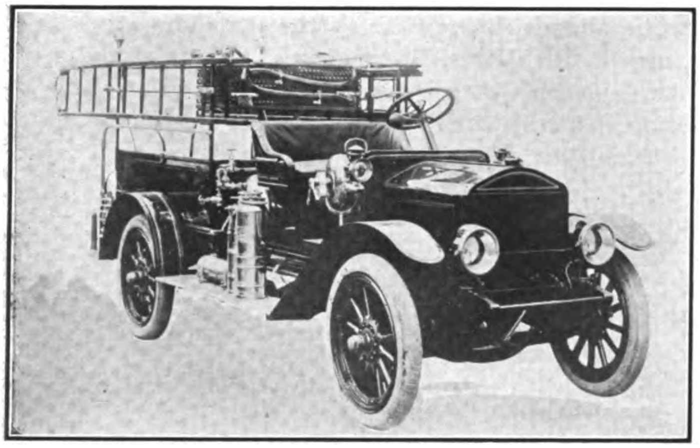
The motor driven ambulance is a great advantage over the old horse drawn wagon in winter, because we utilize the exhaust from the motor to heat the interior, and the patient is much more comfortable as a result. Patients also are benefitted by the fact that the present ambulance is smooth riding, while the vehicle behind galloping horses gives a good deal of jouncing and jerking that is not appreciated by the man or woman who is badly injured or is ill.

Dr. Shannahan is authority for the statement that Worcester is soon to have a new ambulance, one which he believes will be the only one of its kind in the state. Besides other modern improvements, there will be a reservoir on top of the car and a sink in one corner of the interior, so that hot water always will be close at hand. He says it is the only machine of the kind in use, except those owned by the Bellevue Hospital in New York City.

STUDYING GARBAGE DISPOSAL.

Engineers of the Knox Company Offer Solution in Knox-Martin Tractor.

Within the past few months the subject of garbage disposal, and the relation of the motor vehicle thereto, has been given serious consideration by a large number of cities. The engineers of the Knox Automobile Company, Springfield, Mass., have been giving the matter extensive study, and believe they have the proper solution in the use of Knox-Martin tractors,



Brown Combination Chemical Engine and Hose Wagon.

several of which have been installed in this class of civic service.

In the Knox plan the horse carts collect the garbage from house to house, but instead of making the long, hard haul to the refuse plant, which usually is located in the outskirts of the city, each team draws its loaded wagon to a convenient junction point, where the body is jacked up at the forward end. The king pin is removed and the team with the forward axle is attached to an empty wagon, which has been jacked up similarly and is waiting.

During the night, or at any other convenient season, the tractor picks up these loaded wagons and hauls them to the refuse plant. An additional advantage in this method is found in the fact that the wagons being covered, there is no objection concerning the odor and no dropping of particles of garbage, as is necessary where the load must be transferred from one vehicle to another, which is sometimes done to avoid the long haul with the horses. It also is pointed out that there is considerable saving in economy, since one tractor can do the work of several horses.

PRAISES WHITE PATROL.

Superintendent Pierce of Boston Police Department Says It Has Given Entire Satisfaction.

William H. Pierce, superintendent of the police department in Boston, Mass., is authority for the statement that the cost of maintaining the White police patrols in that city has been very slight. He adds that the city has three of these vehicles and has ordered two more.

The first White patrol in Boston was placed in service June 5, 1912, and its total mileage to Sept. 1 was 9588 miles. The capacity is one-ton and it will carry 12 officers. Besides using the wagon for arrests, it also is employed for transporting prisoners from the Hyde Park police station to the court house in Jamaica Plains, a distance of six miles, and it is used for this service every day.

"In my opinion," says Superintendent Pierce, "the weight and carrying capacity of the wagon is the proper standard for the purpose for which it is used." Before purchasing a car for this department, investigation of various makes was made, and the officials came to the conclusion that the White was the best adapted to the work. "It is giving us entire satisfaction," is the superintendent's statement. "In fact, we are justified in saying that we cannot speak too highly of the White gasoline patrol wagon."

TIRES FOR FIRE WORK.

Goodyear Official Offers Some Suggestions Concerning This Class of Service.

F. H. Sawyer, manager of the fire truck tire department of the Goodyear Tire & Rubber Company, Akron, O., is of the opinion that the abandonment of the horse drawn fire apparatus is inevitable. He bases this conclusion largely upon the fact that it is now possible to transform the present equipment into motor driven apparatus at comparatively slight expense through the use of tractors.

He cites the fact that millions of dollars are invested in horse drawn apparatus, which would be entirely lost were it not possible to secure the benefits and advantages of a motor driven piece through the use of a tractor. This means, of course, the retention of practically the original equipment, with the exception of the front wheels, and obviates the expense of purchasing an entirely new machine. Mr. Sawyer says:

In fire department service the most important requisite is reliability. The demands of fire apparatus in responding to a call are imperative, and the machine must get to the scene of the fire without delay. In dealing with reliability, tire equipment is essential. It must be borne in mind that the problems involved in fire department service are far different from those encountered in pleasure vehicles. Motor driven fire apparatus weighs four or five times the average weight of a touring car, and the combination of excessive weight and high speed demands tires that contain the correct design and highest quality of workmanship and material. No tire can be a success if it fails to meet fully these requirements.

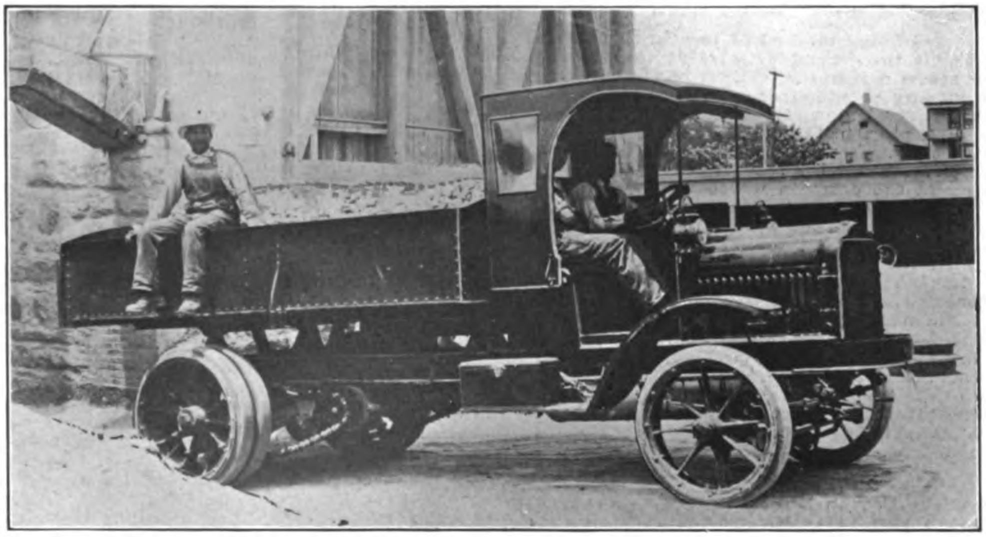
Incidentally, the question of tire expense is affected in a decided manner by the use of tractors, an added factor of interest when considering the question of motorizing existing equipment.

SAVES 16 CENTS A TON.

City of New Bedford Finds White Truck an Economical Proposition.

Officials of the street department in New Bedford, Mass., purchased a three-ton White dumping truck, through the local agent, the Auto Supply & Selling Company, last June. The machine is utilized in hauling road making materials, and the dumping mechanism is so arranged that it is operated by the power of the motor, thus making it possible for one man to do all the work.

Superintendent C. F. Lawton reports that the truck has fulfilled all expectations in the matter of reducing the department's hauling charges. On the first job, where it was used in transporting cracked stone, the cost a ton was reduced from 21 cents to five. Since that time, and in similar work, the machine has shown a transportation cost of less than four cents a ton. Mr. Lawton explains that these savings have been made on hauls of moderate length, and that they would have been somewhat larger on long hauls. "We find the truck is available for quite a variety of jobs and has proved its economy wherever used," he says.



White Three-Ton Dumper in Service with Street Department in New Bedford, Mass.

The success which has attended the use of this truck has been such that the city is now considering the purchase of additional White machines.

NEWS FROM VARIOUS CITIES.

Knox-Martin Tractor for Lynn—The fire department in Lynn, Mass., has taken possession of the Knox-Martin tractor, built by the Knox Automobile Company, Springfield, Mass., for use with its hook and ladder truck.

Selects A. & B. Tractor—Making its selection from five bids, the city council committee on fire department in Beverly, Mass., has decided to award the contract for a new motor tractor for the engine at the West street station to the American & British Company, Providence, R. I.

Malden Considers Purchase—The board of aldermen in Malden, Mass., has before it a request from Police Commissioner Warren for an appropriation of $3000 with which to purchase an automobile patrol wagon, and another appropriation of $3600 for an automobile ambulance.

Buys Two White Ambulances—Dr. A. C. Thomas, superintendent of the New Haven Hospital, New Haven, Conn., has purchased two ambulances, and expects to be able to extend the service of the institution to include the towns of Branford, Orange, Milford, Shelton and Ansonia. The chassis will be built by the White Company, Cleveland, O., and the bodies by M. Armstrong & Co. of New Haven.

Considering Electric Patrol—The city commissioners of Pensacola, Fla., are considering the advisability of purchasing an electric patrol wagon for the police department. The present wagon has three drivers, the salary for whom totals over $200 a month, while three horses are fed at a cost of $50 a month. It is estimated that all of this expense would be eliminated with the acquisition of the electric patrol, since the policeman now designated as wagon officer accompanying the vehicle would be able to drive as well as assist in making arrests.

First of Its Kind—The fire department in Burnham, Penn., recently took delivery of a fire department wagon assembled by the Shaffer Wagon Works, 5 North Cameron street, Harrisburg, Penn. The chassis was made by the International Harvester Company of America. The body was constructed to the specifications of the Burnham officials, and is said to be the first of this design to be built.

Wants Ambulance, Too—The fire department in Haverhill, Mass., recently placed its newly acquired motor fire fighting apparatus on public exhibition, alongside the horse drawn ambulance owned by the city. Instantly, there arose a demand for a modern vehicle to replace the antequated hospital wagon.

New Commercial Car Accessories

A-B Magnetic Trouble Lamp.

The Adams-Bagnall Electric Company, Cleveland, O., is marketing an electric trouble or inspection lamp that differs from usual design in that it is of the magnetic type, and when its base is placed in contact with iron or steel, it will stick. This is due to magnetism and it is claimed that the magnet has a pull of 13 pounds. The device makes for convenience in that it may be placed as desired, to project the rays of light onto the work and to permit of the use of both hands when making adjustments or repairs. The magnet is covered with aluminum and the silver plated reflector is 2.5 inches in diameter. It is equipped with a flexible lamp cord and terminals for attachment to the storage battery.

Se-ment-ol.

The Northwestern Chemical Company, Marietta, O., is marketing Se-ment-ol, a chemical preparation which is a powder that is soluble in water, but which congeals when exposed to the air in liquid form. It is utilized for stopping leaks in the radiator or other components of the water cooling system, being poured into the cooler and circulated by running the engine. When it comes in contact with a leak it forms a cement in a very short time. It is stated by the maker that it will not injure the radiator or impair its efficiency. Much of the deposits caused by the use of hard water are removed by its use. It comes in small packages and is inexpensive.

Dalitz Spark Plug Tester.

The usual method of locating a missing cylinder is to short circuit the secondary wire at the spark plug. When utilizing a screw driver for testing, one is likely to receive a shock unless care be exercised. The Dalitz Manufacturing & Sales Company, 803 Union street, Seattle, Wash., is marketing the Dalitz spark plug tester, which is a simple device for attachment to the plug. It comprises a flat strip of metal, having at one end a terminal for the reception of the secondary wire, and an opening at the other in which is inserted a movable arm of metal. This arm is equipped with a non-conducting handle, preventing any possibility of shocks when using the device. To cut out the ignition to a cylinder the movable arm is slid downward until its end comes in contact with the base or shell of the plug. This effectually grounds or short circuits the current, preventing it reaching the air gap. The device may be utilized for a number of other purposes, including that of testing the strength of the secondary current. This is performed by moving the arm in proximity to the base of the plug and noting the intensity of the spark. The tester may also be employed to note the compression of each cylinder when in operation, by the strength of the explosion. Another use for the device is locking the ignition. This is accomplished by grounding each arm when the car is left unattended.

Dayton Valve Lifter.

The Dayton Malleable Iron Company, Dayton, O., is marketing a new valve lifter which is a U shaped member with integral tapered points. It may be utilized in the conventional manner or to compress the spring by inserting the points between the coils. It is operated by a wing headed screw bolt having sufficient leverage to compress the spring with a minimum of effort, and one of the features of the device is that both hands may be used in displacing the locking mechanism of the valve, the tool remaining in a locked position. The maker states it will fit all types of motors.

Gallagher Carburetor.

The Gallagher carburetor is manufactured by the Gallagher Carburetor Company, Inc., 1876 Broadway, New York City. It is mechanically operated without springs, cams or balls, and it is stated that there are no automatic movements to be affected by fuel and atmospheric changes. The supply of fuel and air is regulated mechanically and all parts are adjustable to meet the requirements of service. Two jets are utilized, one a fixed member and the other a mechanical, the latter coming into operation when the throttle is opened. The fuel supply to this jet is operated independently from the fixed member by a mechanical needle which comes in contact with the nozzle when the throttle is opened, admitting gasoline in proportion to the air. The fixed nozzle is supplied with fuel by a set needle valve and it has its own air intake. It is utilized for starting purposes and low motor speeds. The needle valve controlling the flow of fuel to the float chamber is adjustable by simply removing a screw cap. Provision is made for hot air or hot water heating, or both. It is stated that the carburetor is easily adjusted and provides maximum efficiency with a minimum consumption of fuel.

Fogg Horn.

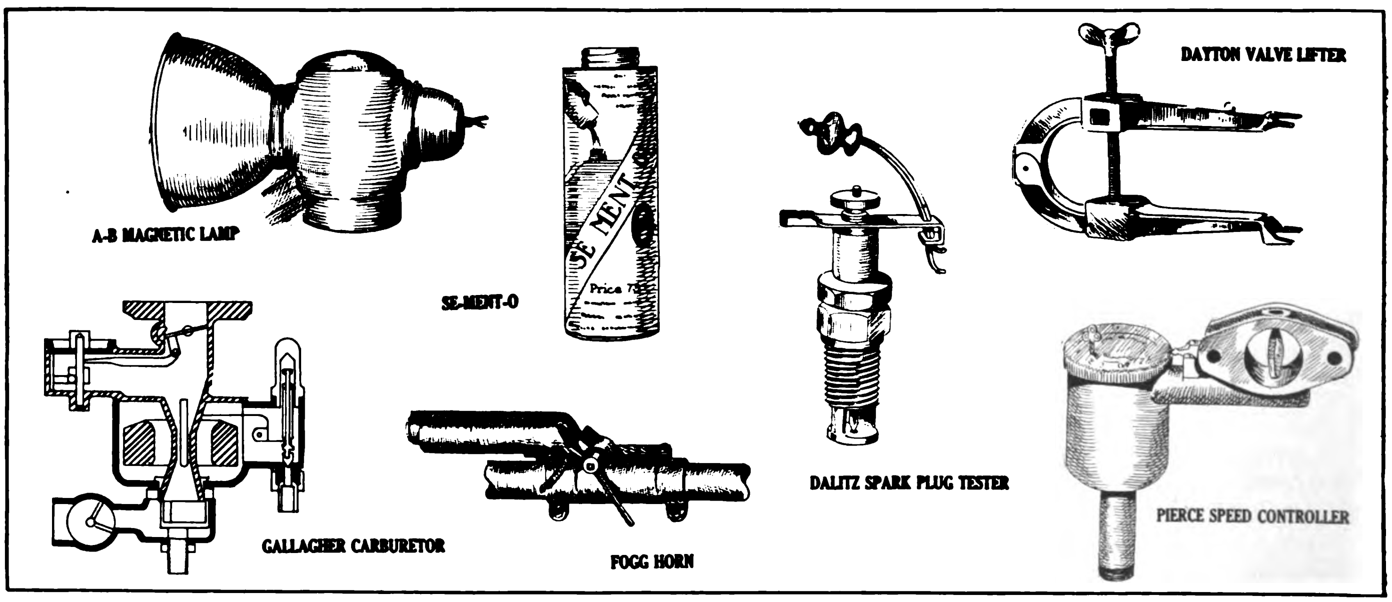
Although designed for model T Ford automobiles the Fogg horn manufactured by the Motor Specialties Company, 2 Cooper lane, Waltham, Mass., may be fitted to other cars. It is operated by the exhaust gases, is very compact and well designed. It is a simple construction and is installed between the engine and the muffler so that a leak in the latter does not affect the efficiency of the signal. The horn is so arranged that the sound is thrown forward, not backward, insuring a volume of tone, even with the motor operating slowly. There are few moving parts, and no opportunity for back pressure or clogging. It can be installed so that it does not interfere with the use of the usual cut-out.

Pierce Speed Controller.

A form of governor, differing from conventional practise in that it can be set for different speeds and locked, the owner retaining the key, is the Pierce speed controller, manufactured by the Pierce Speed Controller Company, Anderson, Ind. It is mounted between the carburetor and the intake manifold and regulates the supply of fuel by means of a butterfly valve. The last named component may be so set as to limit the vehicle speed as desired, a dial being incorporated for adjusting the mechanism, and fitted with a lock. The device does not affect the speed of the machine until the set speed is exceeded. All parts are enclosed so as to be dust, water and tamper proof. The price varies according to size.

Defiance Lock.

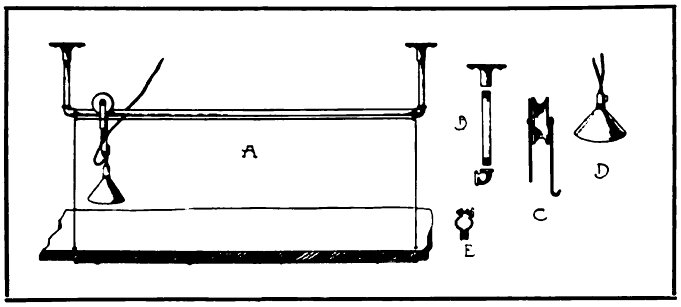
The Defiance lock is marketed by The Defiance Manifold Lock Company, San Francisco, Cal., and is a controllable cut-off valve fitted to the intake manifold. The locking device is provided with a key which is removable. The Defiance lock is made in several sizes and may be fitted to any make of car.



Illustrating Some of the More Recent Accessories Adapted to Commercial Vehicles, Repair Shop, Etc.

HINTS FOR PROPER MAINTENANCE.

A WELL lighted work bench is essential to the garage and repair shop, and while the majority of installations provide a drop light, two or more of the



Working Plan of Adjustable Light for Work Bench: A, Showing How Light May Be Moved as Desired; B, Supporting Arm; C, Pulley; D, Lamp; E, Cable Carrier.

lamps may be fitted when the bench is very long. The disadvantage of a fitted light is that the workman is often obliged to move the work under the lamp, and when he wishes a tool at the other end of the bench must swing the light in the direction of the object sought.

In an accompanying illustration is shown a method of constructing a light rack over the bench, the sketch at A depicting the operation of the light, and it will readily be seen that it is possible for the workman to be at the extreme right of the bench and roll the lamp to him by means of the cable located under the bench, as shown in the drawing. Some benches, however, would not be adaptable to its use.

The rack is easily constructed and the material required is not expensive. It consists of small gas piping, two standards and a like number of elbows. The material could be replaced with round iron, drilling and threading the parts to fit plates which are secured to the ceiling or wall, according to the location of the work bench.

A supporting arm is shown at B, while the pulley member is illustrated at C. The latter is provided with a hook for attaching the lamp cord and has an extension on the opposite side to retain the pulley on the rod. It is not necessary to fit the cable carrier as shown at E, as the light could be moved by hand as desired. The cable was fitted in the installation noted by the writer, and the inventor of the plan states that it was extremely handy when he wished the use of the lamp at the other end of the bench. In addition to making for convenience, the device is economical, as one light may be utilized in place of two or more.

INGENIOUS GEAR PULLER.

Difficulty is sometimes experienced in drawing timing gears, etc., from their shafts owing to the lack of a suitable tool. Sometimes the wheel is lightly constructed with delicate spokes and to attempt to draw the gear with the ordinary tool usually results in buckling or throwing it out of alignment. In an accompanying illustration is shown a gear puller, the maker of which was awarded first prize in the mechanics' competition conducted by Commercial Motor, an English motoring print.

It is stated by the maker that it will remove a gear without injuring it, as an even pull is obtained at four separate points of the rim when required. This is accomplished by inserting three-quarter pins through the arms of the top, on which the wheel can be placed. When the gears are solid and will withstand more strain, the other end of the dog, with the bent-over legs, is utilized in the usual manner. When the gear has openings the reversible dog may be used as well.

CARE OF SHELLAC.

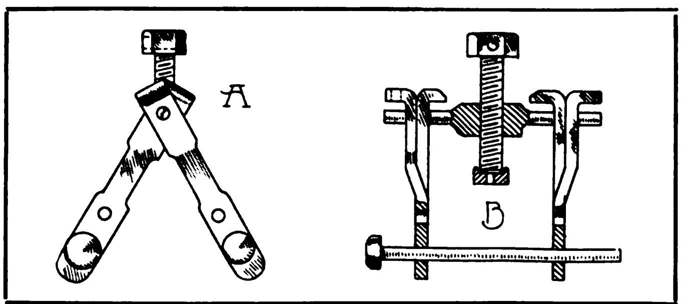
Shellac is very useful in the garage and as it dries up very quickly it should not be exposed to the air. Place it in a bottle and fit a wooden stopper. The latter may be utilized for smearing the liquid when its service is required.

RESTORING DRY CELLS.

Various suggestions have been made for temporarily restoring apparently dead dry cells, among which may be mentioned drilling through the sealing material and moistening the depolarizer with a little water and vinegar. The following hint is given by a battery concern: Take a hard piece of wood and with a light hammer drive down the material surrounding the carbon post. It is said that amperage is increased considerably by this action.

WRISTPIN CLAMP.

The usual method of removing a wristpin from its connecting rod in the overhaul of the motor is to utilize a piece of brass and a hammer, driving out the wristpin. This is not held to be good practise owing to the walls of the piston being fragile and the possibility of damage through carelessness. In an accompanying

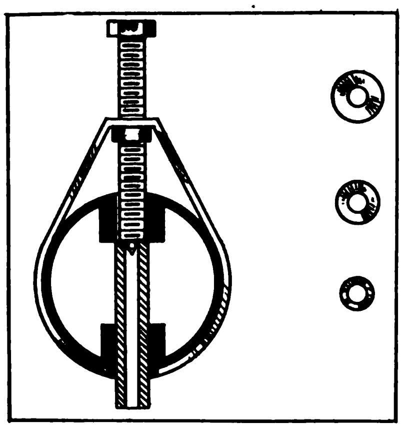


An Ingenious Gear Puller: A, Showing Construction of Device; B, How Four Points of Contact Are Obtained.

illustration is presented a wristpin drawing tool which was constructed by a driver who cares for several machines utilized by a concern with which he is em-

ployed. The device is easily constructed.

It comprises a clamp as indicated, which is slipped over the piston. The clamp carries a threaded bolt, the end of which is turned down to a point and engages with the wristpin when this is of the solid type. By using a wrench, a gentle but considerable pressure is brought against the wristpin and it is stated that the most obstinate part may be removed without danger of injury to the piston. When constructed for the repair shop several sizes of pins could be turned out to meet varying designs of wristpins, including hollow members.



Clamp for Withdrawing Wristpins from Piston.

EFFICIENCY OF DRY CELLS.

The efficiency of dry cells wired in series or multiple series is impaired if one or more of the set is decidedly below the average of the others. Test each cell with an ammeter and throw out any that fall considerably below the others.

Occasionally one will purchase a screw driver the blade of which is too soft. While they should be hardened to a degree of toughness, beyond that is not necessary, as they are not called upon to do any cutting. When water is used for hardening it has a tendency to make the metal too hard. Oil is superior. If water is to be used it should be heated until it nearly reaches the boiling point.

Brittleness of small tools, drills, taps, etc., may be prevented and economy effected by plunging the part into a cake of soap or wax after hardening when being cooled.

GARAGE AND SERVICE STATION EQUIPMENT.

THE Canton Foundry & Machine Company, Canton, O., is manufacturing a wide variety of turntables and in various sizes and capacities. One of the features of the Universal design, shown in an accompanying illustration, is the inexpensive foundation required and the means employed to take care of the accumulation of mud, etc., removed from the vehicle in the washing process. The pit is but 12 inches deep with concrete base, slightly larger than the turntable, and grooved so as to carry all water and debris from the centre to the periphery of the table and into a concrete gutter or drain, which is covered with removable plates.

It is held that the Universal operates so easily that it may be turned by a child. This is due to the serpentine, patented, ball bearing race course, so constructed that foreign elements are prevented from interfering with the movement of the balls. By referring to the lower view in the illustration it will be noted that the top of the table rests on seven balls at the summits, the remaining balls revolving in pockets filled with lubricant. As the table moves the balls at the "high spots" roll and are replaced by others coming up, eliminating friction.

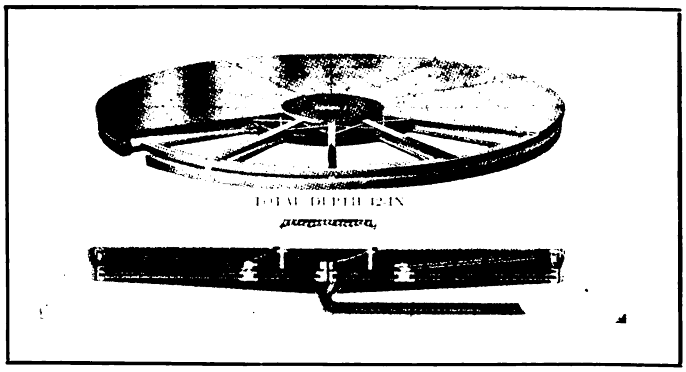
The superstructure is of structural steel built in truss form and reinforced. The top plates are No. 7 gauge steel, securely braced. The table has a checkered iron removable centre with No. 7 gauge steel plates extending to the outer rim, neatly fitted and sloping slightly to provide for proper drainage. The 12 top steel plates are removable and are reinforced by angle irons at proper intervals, firmly riveted crosswise underneath and resting on structural trusses. The table cannot tilt, as the slightest depression throws caster wheels on the outer rim to the rim track. The Universal is made in 12, 14, 15 and 16-foot table diameters, each having a supporting capacity of 8000 pounds, and 16 and 18-foot diameter tables with capacities ranging from eight to 10 tons for truck service.

HARDY RATCHET WRENCH.

A wrench operating on the ratchet principle is the Hardy, marketed by the Hardy Manufacturing Company, Pendleton, O. It is an all-steel tool having five parts, these comprising a handle, two side plates, a ratchet socket and a rivet. The latter is employed to secure the side plates to the handle.

F. & R. PATENT VISE.

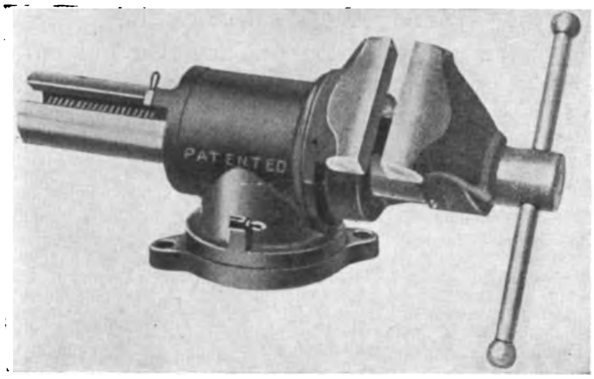
The Fulton Machine & Vise Company, Lowville, N. Y., is manufacturing the F. & R. patent vise in the machinist's pattern. It has the advantage of two complete swivels, a combination of the two giving the



Universal Turntable, Having Ball Bearings and Means for Draining, Is Constructed in Varying Capacities.

most desirable positions for its use by a mechanic. The vise, which is presented in an accompanying illustration, is locked at any angle by two separate methods.

One is by clamping the work within the jaws, which tightens the frictions, the other by the use of the position pins. With both in use it is stated that the vise is



F. & R. Patent Vise Especially Adapted for Motor Car Repair Work.

positively locked in any position. The jaws are always held in place, when the work is removed, by the piston pins, if the operator requires, by the use of which the vise is made stationary at any angle. Cast steel faced tempered jaws are utilized. The vise is made with openings varying from two to nine inches and in six sizes, the weights varying from 6.5 to 155 pounds.

EDWARDS PORTABLE TIRE PUMP.

The Edwards Manufacturing Company, Cincinnati, O., is producing the Edwards portable electric tire pump shown herewith. It is simple in design and throughout the best of material and workmanship are employed. The motor, compressor and tank are mounted on a neat base having three wheels and a convenient handle. The air tank is 12 inches long and six in diameter, and is equipped with a petcock at the bottom, permitting of blowing out any condensation that may exist, also for pumping into the tank direct.

The motor is a .5 horsepower unit, constructed for either alternating or direct current, 110 or 220 volts, 60-cycle, single-phase. The compressor is of the air-cooled type, geared to the electrical unit, with pinions fully enclosed. Eight feet of high grade .5-inch hose with gauge, tank pressure gauge and 20 feet of electric cord and socket are included in the equipment. The switch is located on the motor. Lubrication is provided by means of grease cups on the cylinder and crankshaft bearings. It is stated that the outfit will pump a 34 by four-inch tire from flat to 70 pounds in 90 seconds. The weight of the equipment is 130 pounds. The company issues a catalogue on portable tire power pumps, grinders, drills, etc., which will be forwarded on request.

NEVER LOOSEN LOCK NUT.

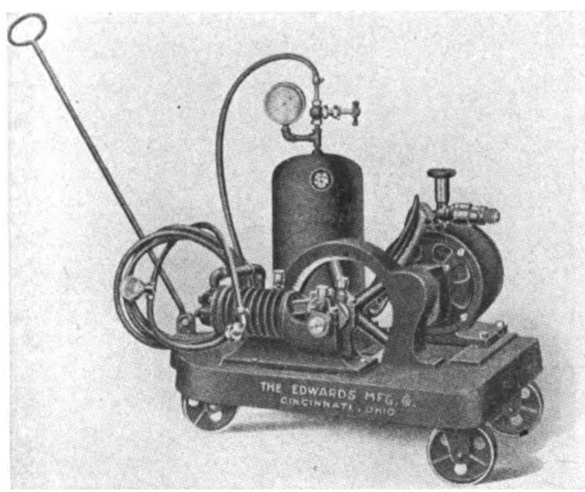
L. L. Swenson, Ottuma, Ia., has invented a lock nut device, termed the Never Loosen, which comprises a split nut having threads for engagement with the bolt threads and adapted for binding engagement on the face of the nut proper, preventing turning of the nut. The locking action is secured by the twisting of the locking nut before the threads are cut. The nut proper is constructed of hardened tempered steel so that when applied to the bolt it will have a tendency to resume its normal shape, thereby locking both the nut and the bolt.

J-M MOBILENE PACKING.

The H. W. Johns-Manville Company, New York City, is marketing the J-M mobilene sheet packing, which is designed for service where extremely high temperatures are encountered, such as the exhaust manifold, etc. The packing is constructed of asbestos with fine brass wires intertwisted in each strand. It does not burn or char and one side is graphited. It is pliable, easy to cut, and being compressible makes for a tight joint. It comes in rolls 40 inches wide and .03125 thick.

SCHWARZ WHEEL SPIDERS.

The Schwarz Wheel Company, Philadelphia, is now marketing its wheel spiders, enabling repairs to be made by the garageman. They are adaptable for renovating wheels which have a number of spokes broken, thereby saving time and the cost of shipping the work to the factory. The spiders are constructed with the Schwarz patent spoke, and these spokes, turned, finished and assembled, form a complete filling for the wheel, with the exception of the felloe. In repairing wheels, it is stated that all that is required is to cut on the round tenons, and put on the old felloe and metal rim. The spiders may also be used in producing new wheels by simply applying new felloes



Edwards Portable Electric Tire Pump, a Simple and Compact Outfit.

amid the metal rims. The centre hole to be bored by the hub is left blank. The spiders are long enough to accommodate any size of pleasure or commercial tire.

CORRESPONDENCE WITH THE READER.

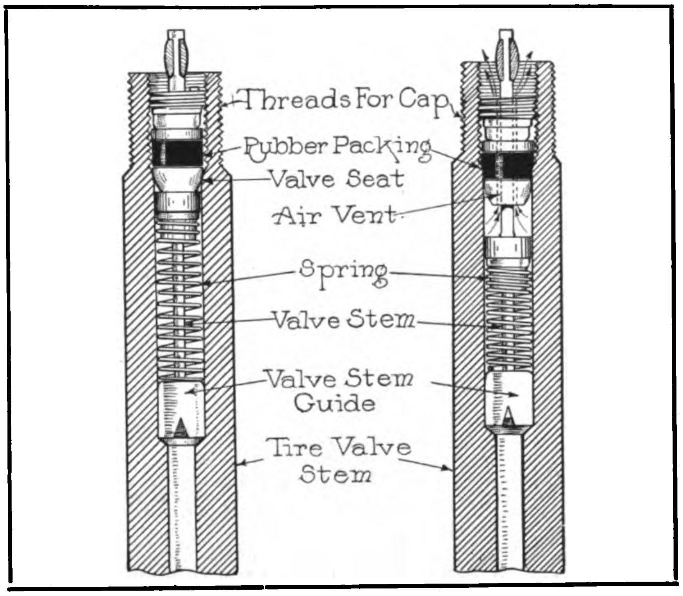
Leaks in Pressure Feed System.

(47)—Some time ago the concern I work for purchased a second hand pleasure car and fitted a body for delivery work. Until recently it has given good service, but I am experiencing trouble in keeping the pressure up and now have to use the hand pump every few miles. Where shall I look for trouble? What causes a tire to soften when the tubes are good and do not leak? J. D. E.

Stamford, Texas, Sept. 17.

The failure of the pressure system is due to leaks and it is probable that a connection has worked loose. An excellent method of locating the leak is to make a solution of soap and water. Pump up the pressure to about 1.5 pounds and apply the mixture to all joints and connections, noting if any bubbles are given off. If any exist, disassemble the part and examine it, replacing with new if found faulty.

It may be that the check valves are dirty. Remove the pipes and test them, also clean the valves. Generally pressure feed systems have a regulating valve, adjustment of which may cure the trouble, providing leaks are not discovered by the soap treatment. The check valves may be tested with gasoline. Excessive lubrication of the motor may be responsible for some of the trouble mentioned.



Sectional Drawings of Valve Stem Showing Function of Components with Valve Seated at Left and Open at Right.

The trouble experienced with tires is due to the valve and this member may be tested by immersing it in a tumbler of water and noting if bubbles are given off. By having the valve stem in an inverted position it is a simple matter to employ the water test.

The failure of valves is largely due to their not being handled properly. Dirt will find its way into the valve mechanism, preventing its seating properly. In an accompanying illustration are shown the components of a valve, the view at the left showing the valve seated; that at the right the plunger depressed and air flowing out as indicated by the arrows.

If the valve proper is prevented from seating by the presence of foreign elements, a slight leak such as mentioned will occur. The seat should be cleaned, an operation requiring the removal of the valve. Sometimes a leak is caused by the rubber packing being bruised and this condition is usually due to screwing in the valve too tightly, a practise that not only destroys the rubber, but makes inflation more difficult. Unless the valve can be repaired it is best to fit a new one, as these members are not expensive.

Switch at Fault.

(48)—What causes the motor to sometimes continue to run after the switch has been moved to the off position? I am driving a machine having two independent ignition systems, a timer, coil and battery for one set of plugs and a high-tension magneto for the other. The switch for the magneto is a plug which is moved in or pulled out. INFORMATION.

Elizabeth, N. J., Sept. 23.

With the true high-tension magneto the flow of the primary current is diverted by grounding it; that is, by a wire led from the primary post on the breaker box to the metal frame. The switch is incorporated in the circuit to close it when it is desired to stop the operation of the motor. The trouble is doubtless in the switch, which does not close the circuit as above explained. It should be a simple matter to remove the member, clean and adjust any loose parts. It would be well to inspect the connection to the terminal on the breaker box.

Make and Break Ignition.

(49)—What is the operation of a make and break system of ignition and how does it differ from the jump spark? Why is it that the jump spark is more used? CURIOSITY.

Peoria, Ill., Sept. 25.

The components of the make and break mechanism consist of a fixed and movable member, one suitably insulated from the cylinder of the engine and the other grounded, so as to complete a circuit when the moving part is in contact with the other part. Upon the hammer separating, a flame is created. With the jump spark system of ignition the electricity is forced to bridge an air space or gap, and because of the current jumping from the insulated electrode to the base or shell, is termed a jump spark. With the make and break system a coil is employed called a "hog" coil, which does not build up the current as does the induction coil because the resistance is slight, whereas with the spark plug considerable voltage is required.

The jump spark has succeeded the older form of ignition in automobile engines because with it the spark may be more perfectly synchronized; that is, made to occur at the proper instant and when the greatest efficiency is obtained from the burning of the mixture. With the make and break there is considerable wear of the contacting parts, some leak of compression and more or less difficulty in synchronizing the break with multi-cylinder engines. The make and break is used with single-cylinder marine engines with success.

The Kearns Motor Truck Company has been incorporated under the laws of Delaware with a capitalization of $100,000.

THE A B C OF MOTOR TRUCK IGNITION.

Part XIV---Outlining the Construction and Operation of the Splitdorf Magneto Which Provides Dual Ignition with One Set of Spark Plugs---How the Current Generated Is Transformed into High-Tension.

By C. P. Shattuck.

IN THE last installment the various types of magnetos utilized for ignition purposes were defined and reference was made to the instrument having a single winding on its armature and employing a transformer for building up the current generated. This type of magneto is termed a high-tension, although a low-tension current is obtained from the instrument itself, because the electricity generated is transformed into a high-tension current and distributed by magneto.

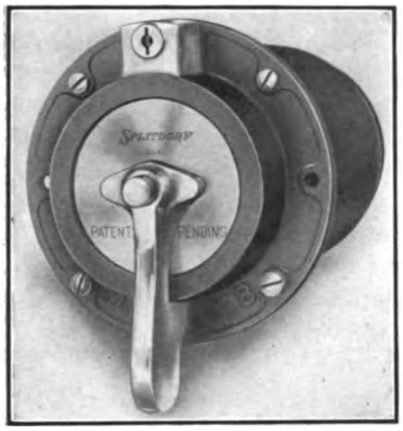


Fig. 71—Unit Switch and Coil.

It is not the purpose of the writer to compare the true high-tension with the transformer types. Each possesses advantages and there is a great difference of opinion between designers and engineers as to which is the better. Advocates of each system present lengthy arguments in support of their claims, but as both systems are in general use, it must be considered that both are entirely satisfactory.

Advantages of Transformer Types.

Since this discussion deals with a transformer system the advantages claimed for it will be presented. It is held by its advocates that the liability of internal short circuits is reduced when a single winding is employed on the armature and current of comparatively low-tension is generated therein; that better insulation can be provided when the transformer coil is made a separate installation, and that this increases condenser capacity. Another advantage held of the design is that dual ignition may be obtained, only one set of spark plugs being necessary. This simplifies matters in that one switch controls both the battery and magneto circuits and but one secondary wire is required for each cylinder.

Although the magneto may be used for starting, the batteries are supplied for emergency use, making starting easier when the motor is cold or when conditions are not favorable to quick turning of the hand crank. With some systems provision is made for starting the motor from the seat by pushing a button, the operation producing a spark in a cylinder by interrupting the primary circuit leading from the cells. This is similar to the result obtained with the battery, coil and commutator system of ignition, where the primary circuit is closed by making contact between the roller and contact block of the timer. Of course, with either installation, there must be gas in the cylinder and the piston must be about to begin the firing stroke.

Although the principles of the single-wound magnetos are practically the same today as when first fitted to the automobile engine, the manufacturer has made many refinements, these including a more compact instrument and better enclosure of the working parts so that moisture and foreign elements do not affect their efficiency. More attention is paid to the construction of the high-tension wire terminals, consequently they are easily removed and replaced; in fact, many former minor troubles have been eliminated by refinements in details.

Single-Wound Armature.

A magneto having a single-wound armature and providing dual ignition is the Splitdorf, made by the Splitdorf Electrical Company, Newark, N. J., the product of which is well known to the automobile industry and owner. The company manufactures a variety of designs to meet the requirements of different in-

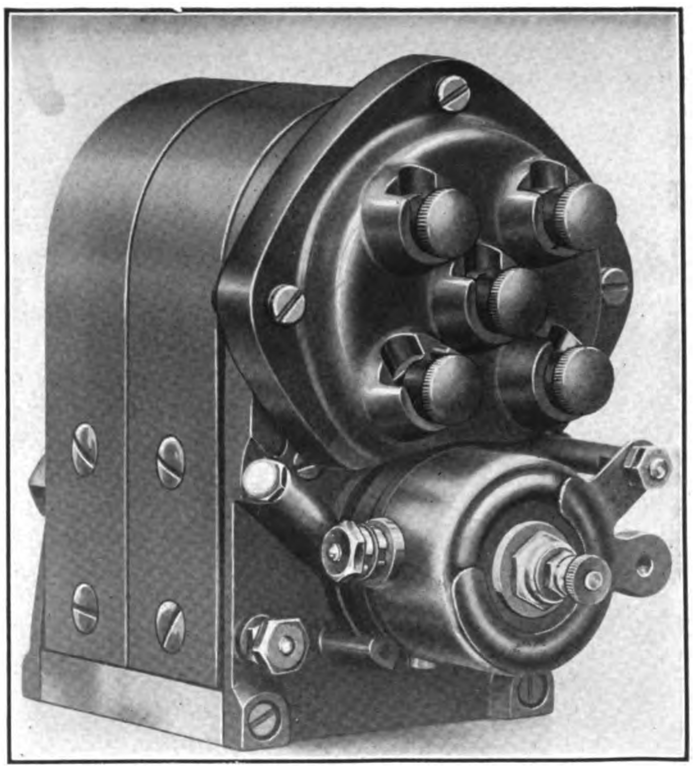


Fig. 72—Model A Splitdorf Magneto, Having Single Winding on Armature, Which May Be Driven in Either Direction.

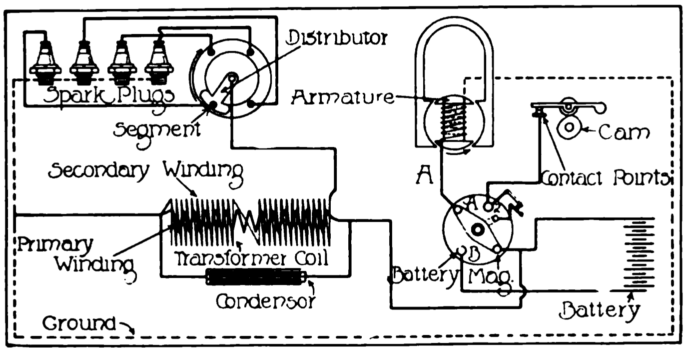


Fig. 73—Diagram Illustrating Principles of Splitdorf Magneto System.

stallations, and in keeping with its policy to improve on past models, has produced a new type known as model A, 1914, which is shown at Fig. 72. Among the features of the new magneto are: All breaker box parts are interchangable throughout, easily demountable and all working parts well protected from moisture.

The complete system includes the magneto, a TSA transformer and batteries. The last named may be any standard six-volt storage battery or dry cells. The switch and transformer coil are a unit, very neat and compact, as will be noted by the illustration at Fig. 71. The transformer is mounted on the base of the switch, the face of which is designed to be mounted on the dash, where it may be controlled by the hand or the foot. The transformer is enclosed in a light water proof case extending through the dash, and being mounted on the base of the switch the connecting leads from the switch contacts to the transformer are very short. The terminal wires from the interior of the transformer are brought to an enclosed casing at the rear, to which point the battery and magneto leads are brought and connected to their respective terminals. On the face of the switch is an ignition button, used for starting the motor on the battery only.

Paths of Currents.

A longitudinal and end view of the magneto is shown at Fig. 76, and the various components are plainly lettered. The armature, which is shown sepately at Fig. 74, has a single winding of coarse wire; is supported by annular bal} bearings as indicated at Fig. 76, and revolves in the magnetic field produced by the permanent horseshoe magnets. One end of the armature winding is grounded, the other is coupled to a conducting member that passes through the contact breaker end of the armature, but is insulated from it.

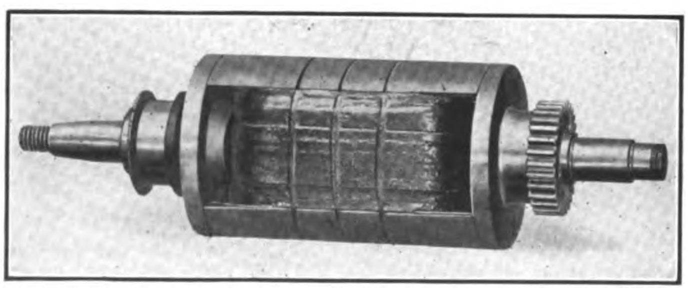


Fig. 74—Splitdorf Armature, Including Driving Gear and Tapered Shaft.

Brushes are mounted in the contact maker cover and bear against the conducting member in such manner as to collect the primary current generated in the armature winding, which is led to the transformer coil.

The timer or circuit breaker parts are shown at the right in Fig. 76, and include a cam which is mounted on the armature shaft. In the design illustrated, which is a four-cylinder unit, the cam raises a contact lever twice every revolution of the armature shaft, interrupting or breaking the platinum contact points apart at those intervals when the armature is in the position of maximum current production, or, in other words, when the electricity generated is at its greatest value. It is at this point of interruption that the high-tension current is induced in the transformer coil and led to the spark plugs.

Operation of Circuit Breaker.

The circuit breaker mechanism is depicted at Fig. 75, but without the cam. It will be noted that the contact lever is pivotally mounted and normally is held against the fixed or lower contact screw by a spring. When the cam comes in contact with the lever mechanism, the two platinum points separate, break-

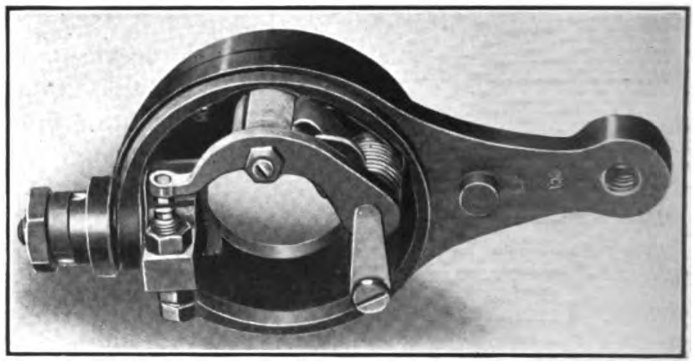


Fig. 75—Circuit Breaker of Splitdorf Magneto Removed to Show Construction and Operation of Platinum Contact Points.

ing the primary circuit. The lower or fixed contact point is made adjustable to provide the proper break, and is insulated from the other parts.

The distributor is mounted inside the magnets, above the armature, and is driven from the armature shaft by gearing. The last named member carries a gear having half as many teeth as the distributor gear, as it makes two revolutions to one of the larger member, as previously explained. The distributor comprises a plate of insulating material carrying a contact segment. The current from the high-tension lead of the transformer coil is supplied to the central brush or terminal of the distributor, which bears against the distributing segment, this in turn making contact with the brushes connecting with the secondary wires leading to the spark plugs.

Operation of Magneto.

The general principles involved in the Splitdorf magneto may be understood readily by a study of the diagram presented at Fig. 73, which shows the wiring and the relation of the various components of the ignition group to each other, although these are not depicted in the exact positions they occupy in actual ap-

plication. With the switch lever in the position shown and the platinum points of the circuit breaker making a connection, any electricity generated in the armature windings is short circuited and flows through a limited circuit formed by the wire A, the switch bar, then from the centre of this to the contact 2, thence to the contact points and back to the armature winding.

When the platinum points are separated by the action of the cam, the electricity flows through the connection A, through the switch bar to the contact at the other end, which leads to the primary coil, and, after passing through this and energizing the core, it returns by the way of the ground to the armature winding. Upon the platinum points making contact, the current from the armature is again short circuited and cannot pass through the transformer primary coil. The path of the high-tension current is followed easily.

Path of Battery Current.

If the position of the switch lever be reversed, so that it is in contact with terminals 2 and B, the battery current is interrupted by the platinum members. The path of the electricity is by the conductor leading from the battery to the terminal B, through the switch bar to the terminal 2, thence to the platinum contact points as long as these are in contact, and through the ground to the primary coil, from which it returns over the conductor leading from the extremity of the primary coil to the batteries. Upon the platinum points separating, a high-tension current is induced in the coil because of the sudden demagnetization of the primary coil core. At this moment the metal distributor segment is in contact with one of the brushes connecting with the spark plug, and a spark occurs in the cylinder.

It will be noted from the wiring plan of the magneto presented at Fig. 78 that the positive and negative wires from the battery are led to the transformer coil and that neither lead is grounded, differing from the battery, coil and timer system of ignition. It will also be seen that the high-tension current obtained from the transformer is led to the central brush or terminal of the distributor. The wiring plan is very simple.

Methods of Drive.

The Splitdorf four-cylinder magneto is driven at crankshaft speed and must be positively driven either by gearing or by an Oldham coupling, the latter being recommended by the maker because absolute setting and alignment are necessary with the first named method. Chain drive is possible, but should only be utilized where a positive drive is not easily obtained.

One of the features of the Splitdorf magneto is that it may be driven in either direction—clockwise or anti-clockwise. If it be desired to change from one direction to another the breaker box is displayed, the driven end of the armature shaft held firmly with a pair of pliers and a small nut removed. The cam, shown at B, Fig. 77, is retained by a Woodruff key and may be removed easily, turned over and replaced. It is advisable in replacing the nut to prick punch it so that it will not jar loose in service.

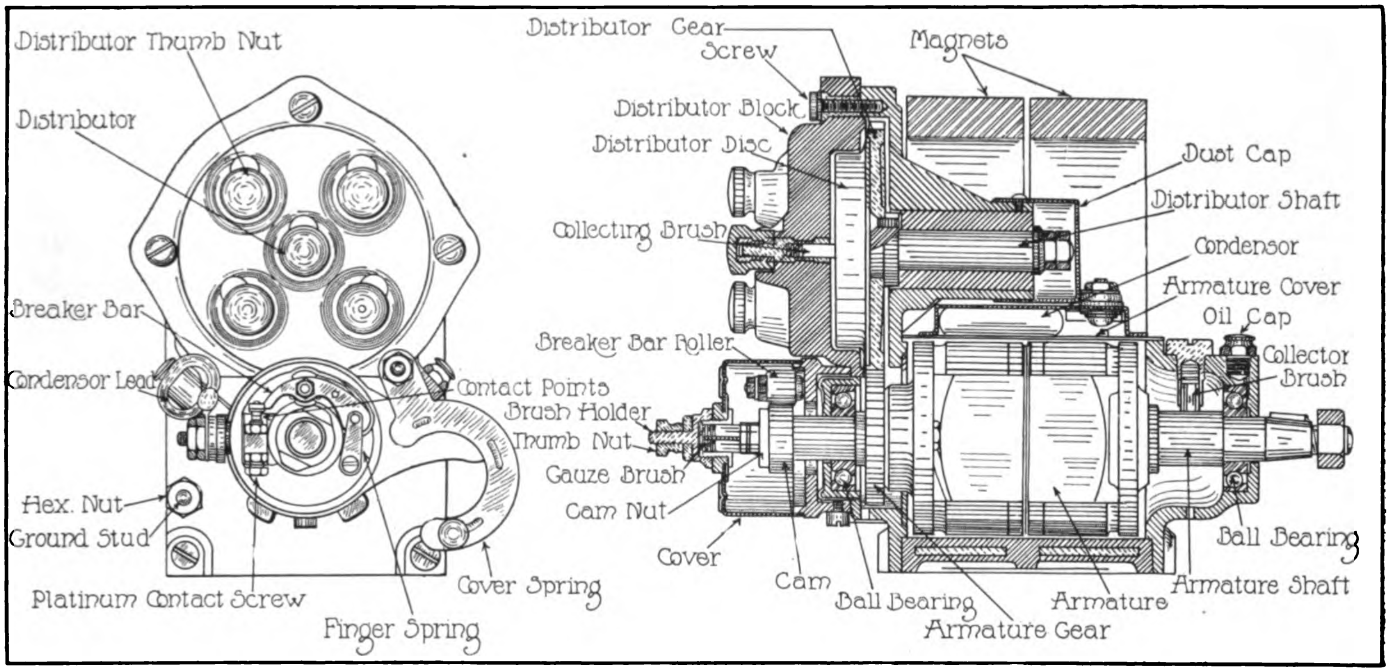


Fig. 76—Longitudinal and End View of Model A Splitdorf Magneto, Outlining Arrangement of Components.

Changing Direction of Drive.

Next displace the distributor block, also the insulated brush located at the driving end of the back plate of the magneto, taking out the four screws retaining it. By removing the back plate and sliding the armature backward, the gears will be moved out of mesh. In remeshing the gears the direction of rotation must be considered. If the instrument is to be driven left handed or anti-clockwise, looking at the driving end, the platinum points S shown at Fig. 77 A should begin to separate as the armature core leaves the pole piece, or when there is a space of about .0625 inch between these members, as indicated in the drawing. The segment should be just under the brush. The view at C shows a magneto driven clockwise or right handed,

and it will be seen that the armature occupies a different position relative to the pole piece than when the shaft was rotated in an anti-clockwise direction.

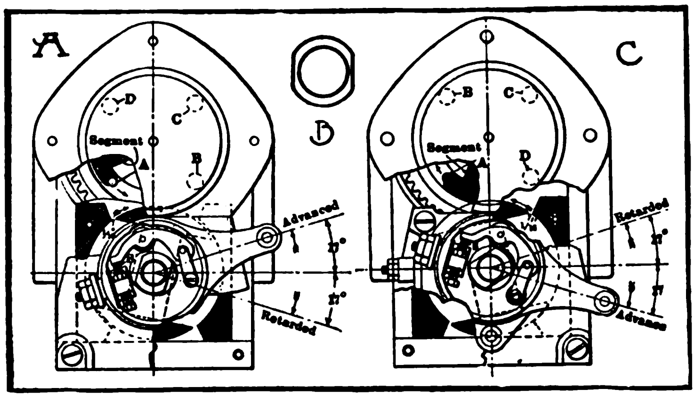


Fig. 77—Illustrating Anti-Clockwise and Clockwise Drive, and Proper Relation of Armature Core to Pole Piece When Changing Direction of Rotation: A, Anti-Clockwise; B, Removable Cam; C, Clockwise.

The model A Splitdorf is timed as follows: Place the instrument on its base and crank the motor until the piston of the first cylinder (that nearest the radiator) is at the top of the compression stroke or dead centre. This may be determined by passing a wire through the petcock or by observing the position of the crank throws of the crankshaft. The spark lever on the steering column is fully retarded and the linkage is connected to the advance lever on the breaker box. If the magneto shaft rotates in a clockwise direction, looking at the driving end, the lever should be placed in its maximum top position as shown at C, Fig. 77. If the shaft revolves anti-clockwise the lever must be at the bottom or as indicated at A. Having ascertained the direction of rotation the armature shaft is revolved until the breaker cam comes in contact with the roller of the breaker bar and the points just begin to separate. The connection between the driving member and armature shaft is then made. It is important to observe that the position of the piston in the cylinder is not changed during this work.

Timing the Magneto.

To connect the secondary wires it is only necessary to ascertain the position of the distributor arm, and its direction of rotation. It should be borne in mind that it rotates opposite to that of the armature shaft. For example: If the shaft revolves to the right the distributor arm will rotate to the left, and vice versa. With the shaft rotating as shown at Fig. 77 C, and assuming that the segment is making contact at A, this terminal is connected to the first cylinder of the motor. The remaining contacts to be made will be B, C and D, but the firing order of the engine must be considered. It will either be 1, 3, 4, 2 or 1, 2, 4, 3, and in fitting the secondary wires to the distributor terminals this firing order must be observed.

In starting on the battery the spark lever is fully retarded and the switch lever thrown to the battery side. If it be desired to start on the magneto the spark should be advanced about one-half or two-thirds way. The best results are obtained from the instrument when the break of the platinum contact points is not more than .03125 inch. The maximum gap of the spark plugs to be observed is the same.

(To Be Continued.)

Ed. Note—The next installment will deal with the construction, operation and installation of true high-tension magnetos.

PACKAGE DELIVERY ECONOMY.

Willys Utility Wagon Increases Business 77 Per Cent. at Two-Thirds the Cost.

The use for two months of a Willys Utility wagon of 1500 pounds capacity by a department store in the Middle West has shown decidedly interesting and economical results. The superintendent of delivery is authority for the statement that the increase in business is 77 per cent. with a saving of 33 per cent. in operation and maintenance cost when three horse wagons were used for this work.

During the period stated the wagon delivered 9246 packages a month as against 5328 packages for the animal wagons, and the cost of delivery was reduced from 3.5 to 2.30 cents a package. In making comparison the packages delivered were rated at a dollar each and the profit placed at 10 per cent. on each. On this basis the net income of the store was increased $391.80 a month, and a saving of $110.95 a month, or a total of $1331.40 a year, made in the operation and upkeep expense of the store's delivery system. The saving that appears practical is not far from the cost of the machine.

The sale of five 1500-pound KisselKar delivery wagons to L. S. Donaldson of Minneapolis, Minn., replacing five other machines, gives that merchant a fleet of 10 KisselKar machines. The first KisselKar was bought June 15, 1912, and in July of this year two more were purchased. In August two additional wagons were delivered, and in September five. Five of the largest department stores of Minneapolis and St. Paul are now using KisselKar delivery wagons exclusively.

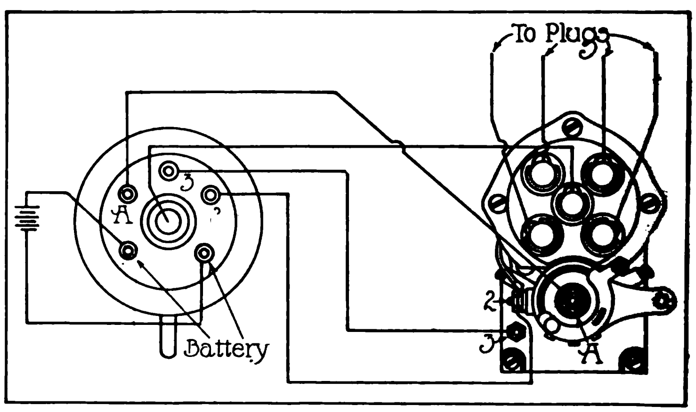


Fig. 78—Wiring Plan of Splitdorf Magneto—Note That Both Leads of Battery Are Attached to Transformer Coil, Not Grounded.

"ELECTRIC VEHICLES."

An Analysis of the Utilities and the Possibilities of a Means of Transportation That Is Being Carefully and Scientifically Promoted in America.

By Arthur Williams, President of the Electric Vehicle Association of America.

THE electric motor car, as an adjunct of modern life, has come to stay, because it has a distinct and proven field of usefulness. Today its advocates firmly believe that, while gasoline vehicles may be better suited to touring and long-distance hauling, electrics are their superiors for delivery service, short hauling and most city demands. Within the last two years thousands of converts have been won over to the electric automobile and that industry has grown with remarkable swiftness.

Some 30,000 such vehicles are now in use throughout the United States. Of this total, about 10,000 were manufactured during the past year; 6000 of these being pleasure cars and the other 4000 commercial wagons. About two-thirds of all the electrics operated in this country are pleasure vehicles, the remaining third being designed for business purposes. Oddly enough, perhaps 80 per cent. of the latter are in use east of the Alleghanies; while by far the heaviest demand for pleasure cars comes from the Middle West. This, of course, speaks well for them, since it proves that, unlike the prophet in the proverb, they are honored in their home territory, being most favored in regions where they are manufactured and where, consequently, they are best known. In New York City only about 400 electric pleasure cars are registered, but Chicago is on record as possessing about 2200. On the other hand, New York uses nearly 1700 electric trucks and delivery wagons, as against Chicago's 460.

Everywhere current driven automobiles are gaining popularity. In New York between July 1, 1911, and July 1, 1912, their number grew 45 per cent.; while an authority on electrical affairs estimates that in Chicago this method of trucking has increased 400 per cent. during the last two years. At St. Louis, for the first six months of 1912, one central station reported a gain of almost 37 per cent. in income from charging cars. Such recent and rapid strides into public favor are due to several causes, among them: Improvement in the cars themselves, decrease in the cost of current, better charging facilities and co-operation among all those interested in the progress of electric vehicles.

Most fundamental of all these causes are changes for the better which have been wrought in the cars. It is a well known fact that early models—those of the '90's—though by no means as impracticable as their detractors represented them, were often clumsy, complex of mechanism and equipped with inadequate batteries. Today, however, the electric is the simplest to operate of all motor cars. Years of experimentation have developed the capacity of batteries, so that the average distance which a pleasure vehicle can now travel upon a single charge has been increased to 65 miles, while a maximum of 100 miles, under favorable conditions, is boasted for not a few.

Then, too, the cost of current has grown steadily less, while that of gasoline is constantly rising. Ten years ago the price of current for charging averaged about 23 cents a kilowatt-hour throughout the United States; but today it sells, on the average, for about five cents a kilowatt-hour, with a reduction to three cents for large consumers. Meanwhile, the price of gasoline has soared. Though a decade ago it was only 10 cents a gallon, the same amount at present costs about 24 cents, and demand will continue to make it grow dearer. Current, on the other hand, since it can be generated in unlimited quantities and since this particular form of supply constitutes an "off-peak load", will tend to fall still lower in cost.

Years ago, lack of convenient charging stations was an annoying hindrance in the way of using electric vehicles. But, recently, current replenishing depots have multiplied in cities and on routes between important towns, so that it is now an easy matter for a car to be recharged. Lists of such stations have also been compiled and furnished to owners of electrics.

But among causes for the increased popularity of current fed automobiles, perhaps the most far-reaching is co-operation between car manufacturers, accessory makers and central station authorities. Such a spirit of mutual helpfulness rather than of rivalry is, of course, unusual in business and has been brought about, in this instance, almost wholly through efforts of the Electric Vehicle Association of America. The aims and accomplishments of this organization will be described later, but here it is interesting to call attention to the fact that, though the association has been in existence only two years, this period is coextensive with that of greatest prosperity in the electric vehicle industry.

Before turning aside from the consideration of the cars themselves, it may be best to put the question: What are their advantages? In other words, what qualifications for city use do they possess which lead a merchant to abandon, in their favor, his horse drawn vehicles? The answer, in three words, is: Economy, safety and reliability.

In the matter of economy, several facts must be taken into account. In the first place, one electric truck or delivery wagon—owing to its greater rapidity—can do the work of several horse drawn vehicles. The average life of a horse, pulling heavy loads over city streets, is four years, while that of current fed trucks is twice—sometimes three times—as long. Besides this

the electric truck is proof against the diseases to which horseflesh is heir, and which killed 19,163 animals in New York City between October, 1911, and October, 1912. Then, too, it is so simple in mechanism that an ordinary teamster can learn to drive it. Altogether it has been estimated that current driven delivery is from 10 to 25 per cent. cheaper than hauling by horse.

The advantages of reduced fire risk involved in the use of electric vehicles must be apparent. Besides protecting the public by eliminating the source of many sudden blazes, absence of inflammable materials in these cars admits them to docks, piers and terminals from which gasoline machines are often excluded. Within the last few months the New England Casualty Company—after careful study of the subject—arranged to grant a large reduction of rates to electric vehicles. This decrease will bring their insurance 20 per cent. below prevailing rates for gasoline vehicles.

Ease of operation in crowded streets is another important advantage possessed by the electric, to which may be added special suitability for many stops, starts and waits, such as are often necessary in delivery service.

The popularity of electric commercial vehicles is attested by a long list of well known business houses which employ them. A few among these are: The American Express Company, which uses 300 such cars; the Adams Express Company, with 250; the Ward Bread Company, with 200; the New York Edison Company, which owns 105; Gimbel Bros., New York, with its fleet of 85; the Case & Martin Company of Chicago, which operates 100; John Wanamaker & Co., New York, with its 94; the United States government, which owns 51; the Anheuser-Busch Company of St. Louis, with 57; B. Altman & Co., with 70; Marshall Field & Co., with 18; the Fair, Chicago, with 34; Abraham & Straus, Brooklyn, which uses 20; Frederick Loeser & Co., also of Brooklyn, which possesses 26, and a host of other equally important firms which operate fleets varying in size from 10 up to 70. The examples mentioned serve to show that wherever electric commercial vehicles are adopted, they are used in groups. This is generally brought about through the success of a trial installation of one or two cars.

Lest the reader should think that the electric motor truck is an altogether recent development, it may be worth while to cite the case of one such machine—owned by the Bergdoll Brewing Company—which began its career in 1903 and is still running through the streets of Philadelphia. During four of these years of active service it was not out of commission a single day. Another veteran is the "Mary Ann," the original motor dray of the New York Central Brewing Company, which, built in the late 90's, still goes out on business in all weathers, and which costs her owners less than $100 a year for repairs. These old timers, holding their own after a decade's use, form a strong argument in favor of current driven vehicles, one which is often overlooked on account of a popular notion that all early models were delusions and snares.

There is no doubt that the Electric Vehicle Association of America has been the moving force in waking the electric automobile industry from its lethargy. This organization's history is brief, for it was formed only in the fall of 1910. At that time, current propelled cars suffered from lack of concentrated effort to push them into public notice. Their makers found the cost of production high, owing to comparatively small sales; storage battery concerns had, accordingly, an extremely limited market for their output, and central station managers, seeing but little demand for current for charging, kept the price of such supply at discouragingly high figures. It was to change these conditions that delegates of these three separate and yet interdependent interests, formed the Electric Vehicle Association of America. Its initial membership of 29 has grown to more than 350; that number at present representing a combined capital account of over $500,000,000.

The keynote of the organization's plan was co-operation, and this has been followed consistently. A joint advertising campaign has been carried out in all parts of the country, any asserted advantages of one make over another having been ignored, but every effort being made to bring to the notice of the general public the good points of electric motor cars. Besides this, arrangements have been effected within the association for interchange of information and ideas, and for the study of pertinent problems.

As results of these activities, the organization points, first of all, to the recent remarkable prosperity of the electric automobile industry. And it is an undeniable fact that this "boom" has been felt since the Electric Vehicle Association of America began its efforts. Contributing causes to this success may be found in the multiplication of charging stations—brought about through the association—and in the standardizing of the charging plug—also recommended by the association. In addition, a uniform sign has been adopted for use throughout the country to indicate battery replenishing stations, and such a sign is at present being manufactured.

The fact that this sign is to be alike throughout the country implies that electric vehicles are not by any means restricted to urban service and that they do travel from one city to another. This brings in the question of good roads; a question in which the Electric Vehicle Association of America takes active interest. Whether in town or country a smooth road bed results in less wear and tear on an automobile, to say nothing of its occupants, and, for this reason, the association has considered methods of preparing and maintaining good street surfaces, together with the manner in which various sizes and styles of tire affect road beds.

What the organization has done in the past, however, is only a small part of what it hopes to accomplish in the future. It intends to carry the principle of co-operation still further, since it is through this practise that success has already come. Among other ef-

forts, it will give attention to further standardization of various machine parts, including styles of batteries, lamp bases and tire equipment. Interchangeableness of parts is a more important feature of the electric automobile than of the gasoline, and adoption of such improvements as seem practicable will undoubtedly increase still further the popularity of electrics.

The future of the current fed vehicle is assured. It has won its way—on merit—into public confidence, and coming years are bound to see a steady growth in its favor. It will commend itself more and more for city use on account of its ease of operation, simplicity of mechanism and reliability. Already, authorities are predicting an output of some 15,000 electric motor cars during 1913, an increase of 50 per cent. over the records for 1912.

In our great cities the hauling of goods will be done to a large and larger extent by electric trucks, because these vehicles can thread their way through crowded thoroughfares, and because, owing to their non-inflammable propelling force, no pier or terminal is closed to them. How great an assistance this will be in solving traffic problems, only those who have studied them can know. It may lead to the hauling of heavy goods through wholesale districts at night, thereby ridding our overburdened avenues of slow moving drays by day, and facilitating the rapid transit of wares to railways and steamships.

The trackless hauling in this country has been estimated at 16 times as much as that done by railways, and of this 80 per cent. is carried on in cities. Now if electric propulsion were adopted for this work, it could be performed more quickly, safely and economically than by horse power and this ought to result in reducing prices of many commodities.

The electric pleasure car will gain an increasing number of adherents on account of the ease with which it may be driven, the low cost of its maintainance, its dependability in all weathers, and the simple requirements for its garaging. It, together with its companion, the current driven truck, will help to gain for the community greater expedition and economy in business and increased comfort and enjoyment in everyday living, as well as cleaner streets, safer highways and reduced fire risks.

EVOLUTION IN DELIVERY.

Requirements by the Public Necessitate Improved Store Transportation.

That there has been an evolution in delivery in practically every form of commerce and industry, which has not been keenly realized because of its being an every day condition, is pointed out by John M. Lansden, second vice president of the General Motors Truck Company, who emphasizes some facts that may be obvious upon reflection, yet which have not received the serious consideration they should. In this connection Mr. Lansden says:

The solution of what appears to be one of the largest problems to be overcome by the men who are working out the marvelous merchandising systems of American cities, seems to lie in the development of the electric commercial vehicle.

Although electric commercial vehicles have been used for almost two decades, it was not until a half-dozen years or so ago that they began to take an important place in our present day scheme of haulage and delivery. Today the electric truck is making the most extraordinary advances in its field—city and suburban use.

Last year the number of electric commercial cars used in some of our metropolitan cities increased considerably over 50 per cent. And a most significant fact is that a large percentage of the machines were sold on reorders. The development of the retail trade in the larger American cities during the past decade has been a commercial wonder to the rest of the world. And it had no experience to go on—no precedent to follow. Improved merchandising methods brought a sudden and enormous increase of sales in all sorts of lines.

Department stores have had a big place in changing conditions, but every sort of retail and mercantile concern has been effected. The concentration of industries has been another factor in increasing the use of electric trucks.

Food, milk and produce supplies have been centred in the cities and all this has tended to multiply the necessity of adequate and efficient transportation methods. The manufacturer of supplies—as he may be called—the baker, the brewer, florist, soft drink maker—and the middleman, like the wholesale meat or provision dealer—have come to the same relation to their customers (the grocer, the drug store and the butcher shop) that the dealer has always occupied toward his customers. Meanwhile the buying public has demanded that its supplies be fresher than in less discriminating days, as well as greater in variety and better in quality.

So the wholesaler has had a new delivery problem to meet and like the retailer, it has been rapidly complicated by the constant widening of the territory in which business is transacted.

The horse has failed to meet the emergency. Being only flesh and blood, he has only flesh and blood endurance. He could make just so many miles a day at such a speed. He had to be given occasional rests. He had to be allowed a certain amount of sickness. And with the increasing strain, he not only could not cover the ground that had to be covered with the spreading out of our cities, but he became less reliable in the field which represented the utmost of his ability.

It was these weaknesses of the horse that gave the commercial vehicle its first start. And the inherent qualities of the electric truck have brought it into prominence as a substitute for the horse in city and suburban delivery work.

The electric truck is unusually easy to operate. Its care is exceedingly simple; and altogether it meets in an eminently satisfactory manner the new conditions of merchandising distribution in our rapidly growing American cities.

The annual meeting of the Electric Automobile Manufacturers' Association was held at Cleveland, Sept. 10, and in connection with the usual business officers were elected as follows: President, Louis E. Burr, Woods Motor Vehicle Company, Chicago, Ill.; vice president, R. G. Norton, Baker Motor Vehicle Company, Cleveland, O.; secretary and treasurer, F. H. Dodge, Ohio Electric Car Company, Toledo, O.; executive committee, G. D. Fairgrieve, Anderson Electric Car Company, Detroit, Mich.; H. H. Rice, Waverley Company, Indianapolis, Ind., and C. F. L. Fisher, Rauch & Lang Carriage Company, Cleveland, O.

The Phoenix Rapid Transit Company, Phoenix, Ariz., which operates a trolley system in that city, has decided to experiment with the motor passenger conveyance to determine its economy as compared with track roads. The company has purchased a three-ton KisselKar chassis and will install a 25-passenger body on it and operate it in the sections not now served. If this is a success other machines will be bought.

A second three-ton White truck, equipped with dumping body, has been placed in service by the W. F. Gilbert Company, a well known coal dealer of New Haven, Conn., the results with the first machine amply justifying the purchase of another.

STORAGE BATTERY CHARGING EQUIPMENT.

A Statement of the Needs for Varying Forms of Garages and Service Stations, with Reasonable Provision for Expansion and Meeting All Conditions of Use.

By R. E. Russell.

THE following article by R. E. Russell, an engineer nected with the rectifier sales department of the General Electric Company, Schenectady, N. Y., is of special interest to every person who is considering the installation of equipment for charging electric vehicle batteries. Mr. Russell has taken up a very broad subject and has briefly considered the essential detail of equipment that may be utilized for the private garage, the public service station and the department store garage, dealing with varying currents and voltages, and specifying the economies or advantages that may be obtained from differing apparatus under given conditions. He has also specified the needs for charging both lead-acid and alkali battery cells, emphasizing provision for attention peculiar to each type.

Mr. Russell's article refers to different forms of current supply and differentiates the equipment necessary with such conditions as are customarily met with, and he makes suggestions that will be found of material value to all who are engaged in the manufacture, distribution or use of electric machines. One of the material items of operating expense is the cost of current, and the purpose of the article is largely to advise what will give sufficient and efficient service at maximum economy.

In preparing this paper it has not been, by any means, the intention of the writer to engage in any discussion regarding the relative advantages of the lead-acid battery over the nickel-alkaline or vice versa, but when it comes to charging they must be handled somewhat differently to get maximum results, as to efficiency, simplicity and general good characteristics.

It is the purpose of the writer to recommend charging sets for any ordinary conditions that may exist. It is to be hoped, with the growth of the electric vehicle industry and with the present rate of central station progress, that the many conditions met with nowadays will in the near future be reduced to more practical limits.

Before taking up the various suggestions for charging let us first analyze the conditions as regards battery, supply circuit and number of vehicles.

There are, as already stated, two general types of battery:

1—Lead-acid.
2—Nickel-alkaline.

The supply circuits met with ordinarily (if there is any supply) are:

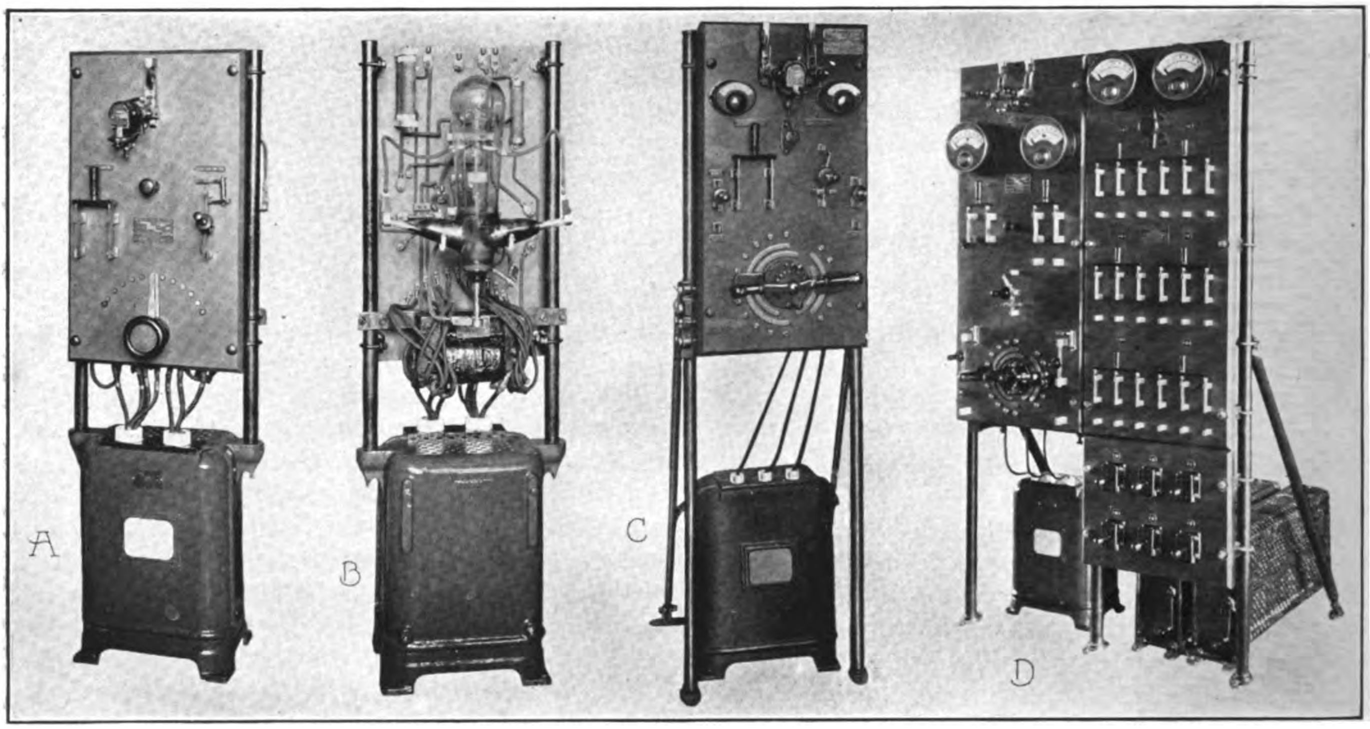
Alternating Current—One hundred and ten and 220 volts or any other voltages that may be required can usually be obtained. The question of number of phases or frequency need not be considered, except that any apparatus purchased must conform to them.

Direct Current—One hundred and ten to 125 and 220 to 250 volts; 220 to 250 volts only, and 500 to 600 volts only.

Probably the hardest part of a charging recommendation is the determination of the capacity of the charging equipment. If in a private garage where only one or two cars are to be charged it is simple. But the conditions are quite different in a public garage, where the batteries may vary from a light 24-cell runabout battery with a charging rate of 19 amperes to a five-ton truck equipped with an Edison A-12 battery requiring 90 amperes normal with a possible boosting current of 450 amperes. To say the least, some study must be given to the conditions.

In order to get some general basis the following classifications are made:

(a) The private garage, usually limited to one or two vehicles.
(b) The average public garage, which starts in on a small basis and yet should be able to charge any transient car which comes in and still take care of regular customers. The cars for the most part will be pleasure electrics, but there may be some commercial cars.
(c) The large public garage, handling as many as 200



Mercury Arc Rectifiers for Garage Equipment: A, Runabout Type, Front View; B, Runabout Type, Rear View; C, Single-Phase Panel, Front View; D, Single-Phase Panel and Garage Outfit, Equipped with Sub-Base.

electric pleasure vehicles and trucks.

(d) The department store or express company garage, caring for commercial vehicles only.

In selecting charging apparatus to meet the various conditions enumerated, the writer has endeavored to keep in mind:

That the efficiency must be high without adding complications; the first cost as low as is consistent with good design; that the apparatus should be well made to keep down the maintenance cost; and that the floor space be as small as possible without sacrificing convenience.

The possible future growth of the garage will make more or larger apparatus and circuits necessary, and should be carefully considered. To my mind simplicity in design of a charging layout is of the utmost importance, particularly in the smaller garages where help is frequently changing and a new man must be quickly "broken in."

The devices which may be used for battery charging are as follows:

For Direct Current Circuits—Charging rheostats and distributing panels, motor generator sets and control panels where the supply voltage is 220 volts or over, boosters or dynamotors.

For Alternating Current Circuits—Mercury arc rectifiers, rotary converters, motor generator sets (A. C. to D. C.), mechanical or synchronous rectifiers.

If central station service is available it is not recommended that a garage generate its own current for charging by means of a gasoline or steam engine and generator, as it is very seldom, and then only under the most favorable conditions, that the private or isolated plant can compete in cost of producing current and in reliability of service with the central station.

Where no central station service is available, as in the case of some summer resort hotels and rural residences, the convenience resulting from providing charging facilities practically amounts to a necessity. In such cases there is frequently installed a small 115 to 125-volt generating set, usually gasoline engine driven, of sufficient capacity to furnish lights and some power for the buildings and grounds. In such installations the factors that make for economy in up-keep and attendance and for the perfect voltage regulation required for high class illumination assure a reliability and dependability that is absolutely necessary for battery charging at such places. The combination of an engine and a generator, neither of which is designed or built for operation with the other, is usually in the long run an unsatisfactory solution of this problem. The increased efficiency and reliability of an isolated generating plant, built specifically for lighting purposes, is well worth the extra cost of such apparatus. Such a set would be equally well adapted to battery charging.

It always pays to buy a good motor generator set, as the higher efficiency, lower cost of repairs and longer life will amply repay the slight difference in first cost.

A rotary convertor with a regulating transformer, or preferably an induction regulator in the primary circuit of each rotary will make a very efficient equipment to change from alternating to direct current for very large garages where at least 75 per cent. of full load can be used at one time while the set is running in order that it may be operated at high efficiency.

At the present time there seems to be no satisfactory mechanical rectifier which will deliver enough current to charge even a single electric vehicle battery. So many inventors are working on various designs of mechanical or synchronous commutator rectifiers that it seems quite possible that we may expect some results before long. Consequently it has been listed above. There is without doubt a demand for a high capacity, reliable and inexpensive rectifier for charging large vehicle batteries.

Now to make suggestions for the various conditions already mentioned:

The Private Garage.

One Hundred and Ten to 125 Volts D. C.—For the private garage having 110-125 volts D. C., a small panel with suitable means for mounting it on a wall and equipped with line switch, fuses, preferably ammeter and voltmeter, and a battery charging rheostat for mounting on the wall beside the panel, makes a very satisfactory equipment. If there are two cars to be charged the panel should be equipped with two circuit switches and an extra rheostat added.

Two Hundred and Twenty to 250 Volts D. C.—For the private garage having only 220-250 volts D. C. (which is very rare), a large battery charging rheostat may be used, but the cost of a five-hour charge at 30 amperes would be about $1.65 at five cents a kilowatt-hour. If a motor generator set were installed the cost of charging the same battery (assuming 30 cells lead) would be about 75 cents, showing a saving in cost of charging of 90 cents. Even though the battery were charged on an average of only once a week the annual saving would be about $40, making a slight allowance for oil and brushes.

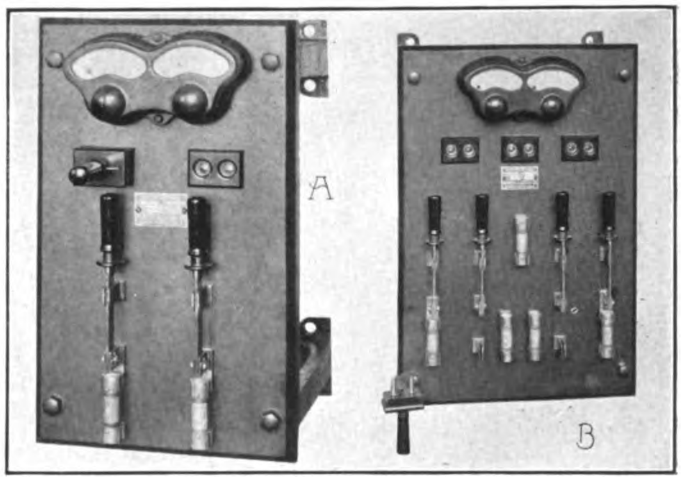
If a higher voltage battery were charged, a 44-cell for instance, and charging done very infrequently, the most economical and simplest equipment would be a charging rheostat and small panel with switch, instruments, etc.

Five Hundred to 600 Volts D. C.—If it can be avoided 500-600 volts should not be recommended for the private garage, and if there is a lower voltage available it should be selected, even though it may be alternating. If there is no alternative a small motor generator set should be installed. The motor should, of course, be designed for the line voltage and large enough to drive the generator at full load. The generator should be designed to deliver 50-125 volts, depending on the maximum voltage of the battery. For a 30-cell lead battery the generator should have a range of from 60 to 80 volts, and if the charging rate is 25 amperes the capacity of the generator should be about two kilowatts.

A control panel should also be installed. On it should be mounted a field rheostat for the generator, a starting rheostat for the motor, ammeter, voltmeter, 500-volt line switch, and an overload and reverse current circuit breaker. If there are two batteries to be charged at once two circuits should be arranged on the control panel and a rheostat should be connected in series with each charging circuit. In this case a larger motor generator set should, of course, be installed.

Alternating Current—For the private garage having alternating current, the mercury arc rectifier has demonstrated itself during nearly 10 years of actual service to be a very important accessory to the electric pleasure vehicle. Since their introduction they have been in constantly increasing demand, particularly in private garages. The reason for this demand is their extreme simplicity, high efficiency, the absence of moving parts—requiring oil and grease—and lack of vibration, making a special foundation unnecessary. The rectifier is also the cheapest reliable device for electric automobile battery charging that can be bought. The rectifier generally used in public and in some private garages is known as the Standard type; and that used in private garages is known as the Runabout type. The Runabout type on account of its extreme simplicity is recommended for charging batteries in private garages, and is particularly suitable for charging Edison batteries. A rectifier of 30 amperes capacity is plenty large enough to charge the average electric pleasure car, but if Edison A-6 batteries are used a rectifier of 50 amperes capacity and of the Runabout type should be used. For larger batteries two 40 or 50-ampere rectifiers can be connected in parallel by adding two reactances, and will make a very simple high capacity set.

Rectifiers for Edison Batteries—The Runabout type rectifier has been recently demonstrated to be particularly satisfactory in charging Edison batteries, especially of the A-4 and A-6 types, which have a normal charging rate of 30 and 50 amperes, respectively. To charge an A-4 Edison battery with this



Private Garage Type Battery Charging Panel: A, Single-Circuit; B, Two-Circuit, for Wall Mounting.

rectifier it has been found desirable to equip it with a 40-ampere tube, so that a charging rate may be started at, say, 35 to 38 amperes. The rectifier will maintain a rate of between 30 and 35 or 38 amperes throughout the greater part of the charge provided the line voltage holds fairly constant and does not droop toward the end of the charge. In a recent test this type of rectifier was connected to 64 cells of A-4 Edison battery and charged them for seven hours. At the start of the charge the direct current reading was 38 amperes; in one hour, 35 amperes; in four hours, 34 amperes; in five hours, 33 amperes; in six hours, 32 amperes; in seven hours, 30 amperes. Throughout the charge the efficiency averaged 77.5 per cent. As the discharge voltage averages considerably higher when the Edison battery is charged at full normal current or over, this test demonstrates the particular suitability of the Runabout type rectifier for this service. When charging an Edison A-6 battery a 50-ampere Runabout type rectifier should be used and the charge started at 50 amperes, and the normal rate should hold up in about the same manner as that outlined above.

Tube Life—Years ago some prospective purchasers suggested that the glass tube which contains the mercury arc on a rectifier would not last. Many of these purchasers of rectifiers are still using them with the original tube, doing the same work which it did over five years ago. It is found that the question of cost of tube replacement is almost negligible, especially when it is considered that the manufacturers guarantee them for a substantial life, and also considering the saving in cost in operating the rectifier in comparison with other charging devices for alternating current.

Home Charging—Probably every electric automobile manufacturer prefers that every pleasure vehicle he sells should be charged in the private garage at home. This is no reflection on the public garage, but is because the owner of the car always has it where he or she can use it at a second's notice; can save the current wasted between home and the public garage; and can, no doubt, save money by putting in a little time charg-

ing it himself (or herself). Some men and women take a certain satisfaction in running their own rectifier and charging their own car. The public garage will have plenty to do by arranging for monthly battery inspections, repairs, painting, etc., besides taking care of those who have an electric with no private garage.

The Public Garage.

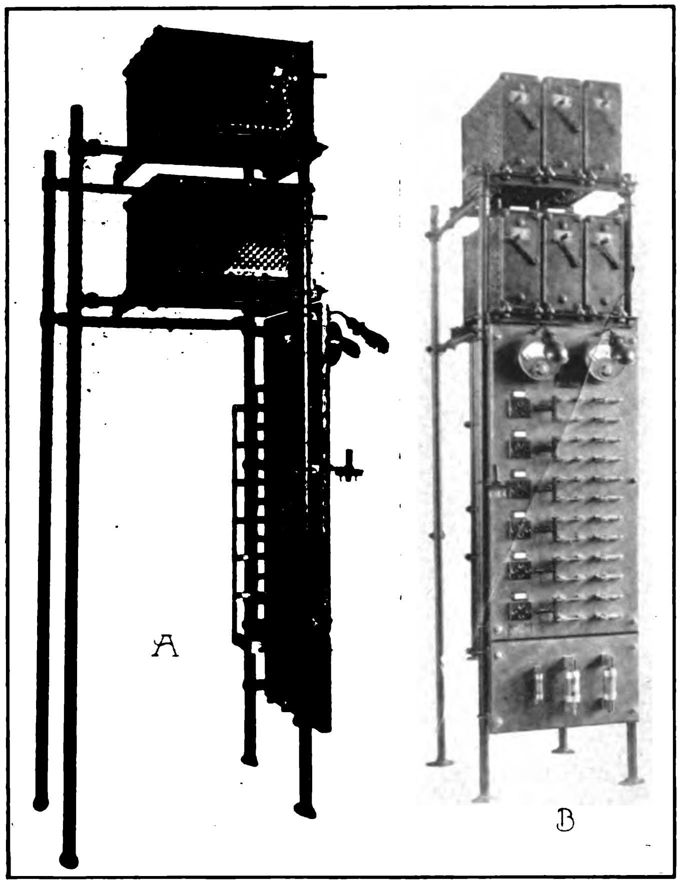
Alternating Current—In the public garage starting on a small scale a single 30, 40 or 50-ampere rectifier, with a wide range of D. C. voltage (30 to 120 volts), will take care of one or two regular customers and a transient car now and then. The 40-ampere size would be the best unless the regular cars require a high charging rate.

The objection to a motor generator set in a small garage, caring for from three to five cars, is that only very seldom can all the cars be charged at one time. A motor generator set should be used at nearly full load to be operated profitably, whereas a mercury arc rectifier will operate as efficiently at one-half current as at full load.

For the garage starting on a small basis the following equipment is suggested for installation as the business grows. It is assumed that the charging rate of each battery will average about 25 amperes.

At start, with one or two cars:

One 30-ampere, 30-100-volt, Standard type mercury arc rectifier.



Six-Circuit 110-Volt Standard Battery Charging Panel, Two-Wire, 360-Ampere Maximum: A, Side View, Showing Standard and Resistance; B, Front View.

On adding one or two cars, add:

One more rectifier, same type.

On doubling the number of cars, add:

One 40-ampere, 230-volt D. C. rectifier, with the charging circuits arranged in series-multiple. This makes a very efficient arrangement and rectifiers are often built with this arrangement.

If there is immediate prospect of a large increase in business, or if large Edison batteries are to be charged to any extent and other batteries are likely to vary in size and in charging current or for any other reason series charging is objectionable, the following equipment is suggested and should be used in place of the 40-ampere rectifier mentioned, retaining the two 30-ampere rectifiers, as they will be of value as explained later:

One motor generator set, consisting of a 15 or 20 kilowatt D. C. generator, 110 to 125 volts, (2.5 or three kilowatt capacity should be allowed for each of the lead batteries to be charged at one time. Edison batteries will require more, depending upon the number of plates and boosting charge required,) direct connected to a suitable size A. C. motor of the voltage and phase of the alternating circuit.

One motor generator control panel on which should be mounted a voltmeter, ammeter, line switch, generator field rheostat, starting compensator for motor and an overload and reverse current circuit breaker.

One distributing panel (or more, depending on the number of batteries to be charged at a time), each designed for six charging circuits. On each panel should be mounted an ammeter, voltmeter and means for connecting each to each charging circuit. For each charging circuit there should be mounted on the panel a double-pole switch with fuses to protect the circuits. It is also advisable, if more than one panel is used, to have fuses of ample capacity in the main line going to each panel.

Six battery charging rheostats (or more if required) which will have sufficient resistance and carrying capacity for the batteries to be charged.

With such an equipment it should be possible to garage from 20 to 30 ordinary pleasure vehicles, as very seldom will it be necessary to charge more than one-half of all the cars garaged at the same time if the charge is completed every time a battery is connected, which should be done for the good of the battery if for no other reason.

In selecting rheostats for battery circuits care should be used to get them with large enough resistance and enough carrying capacity. For ruggedness and ability to stand overloads cast grids make up the best rheostats, if they are strongly assembled and insulated with good heat-resisting material such as mica. Manufacturers of rheostats will recommend the types, resistance and proper carrying capacity of rheostats to use if they are supplied with the name plate rating of the batteries, the number of cells and the voltage to be used in charging.

The rheostats should be mounted on top of the distributing panel with which they are to be used. If they are of exceedingly large capacity and too heavy to mount at the top of the panels they should be mounted as near as possible to the panel with which they belong so that the ammeter can be seen while the rheostat is being adjusted. If the rheostats are mounted above the panels they may be adjusted by means of a special hook on a short pole.

After installation each panel should be numbered and each circuit lettered. The charging circuits should be wired from the panels through a rheostat in each circuit to outlets at convenient parts of the garage. In a garage having large floor space some of the outlets should be placed on the walls and others on the ceiling away from the walls. For those on the ceiling one end of a cord should be attached to the charging cable and the other end to a spring device, like a shade roller, so that when the cable and plugs are not in use they will be pulled up out of the way. Each outlet should be numbered and lettered to correspond with the panel and circuit to which it is connected.

On the card (in the card index) carrying the usual charging record of a car, owner's name, etc., should be one or more circuit numbers corresponding to circuits to which the car may be connected. It is, of course, not necessary, although preferable that a car be always connected to the same circuit, but to get proper results it should be connected to a circuit having a rheostat of proper resistance and carrying capacity.

If a fairly large motor generator set is installed it would not be economical to operate it when only one or two batteries are to be charged. To charge these batteries, one, two, or more, 30, 40 or 50-ampere mercury arc rectifiers should be used. The number of rectifiers will, of course, depend on conditions, such as number of cars charged during the day time and other conditions mentioned later. This makes a very economical addition to the garage equipment. Many large garages are using rectifiers in this way.

There are many public garages caring for from 20 to 70 cars using mercury arc rectifiers exclusively with very economical results, and where the variation in number of cells of the various batteries to be chraged is large, a complete rectifier installation may show greater economy than any other scheme.

In very large garages having motor generator sets of from 100 to 500-kilowatt capacity, a smaller capacity set of, say, 15 per cent. of the capacity of the large set should be installed to take care of lighter loads, as for instance during the day time, to make it unnecessary to run the large set except when at least 50 per cent. of full load can be taken from it. This raises the efficiency of the charging plant considerably without introducing any serious complications.

It is very often possible to lower the D. C. voltage of a generator of a large motor generator set to just take care of the battery having the largest number of cells and gradually raise this voltage as the battery charges. This will materially reduce the losses in battery charging rheostats. Every saving of this kind materially reduces the cost of charging.

Current is often wasted by having, on a large generator, to maintain a high voltage to charge one or two high voltage batteries with a large number of low voltage batteries on the same line. For example: If an 100-kilowatt generator were charging two 48-cell lead batteries, and 29 30-cell batteries, all averaging 25 amperes each, it would be necessary to hold the voltage of the generator high enough to charge the 48-cell batteries, or at an average of about 115 volts. If the 30-cell batteries were charged alone the voltage could be held at 69 volts average. The saving would be about 140 kilowatt-hours (about 28 per cent. saving) during a five-hour charge, even figuring on the slight loss in efficiency of the motor generator due to operating at lower voltage. The 48-cell batteries could be charged from rectifiers.

One Hundred and Ten to 125 Volts D. C.—For large or small public garages having 110 to 125 volts direct current, the charging apparatus consists simply of a suitable number of charging or distributing panels already described and illus-

trated, and a charging rheostat for each battery circuit. With the exception of not using motor generator sets, the apparatus will be the same as in the garage having alternating current, the equipment of which has just been described.

Manufacturers make distributing panels with two, four and six circuits each, but if there is any possibility of future increase in requirements the six-circuit panel would be the cheapest to buy even when starting a garage on a small scale. As requirements increase six-circuit panels may be added to take care of the demand and assembled with those already installed to make a complete switchboard.

In many instances where the D. C. voltage is low it may be necessary to put a small generator driven by a suitable motor in series with either the main circuit or with a part of the main circuit feeding the high voltage circuits which may be charging 48-cell lead batteries.

Two Hundred and Twenty to 250 Volts D. C.—The public garage having 220 to 250 volts direct current only is very rare. Such a garage should use about the same equipment as the garage using alternating current supply, except that the motor generator sets should have 220 to 250-volt D. C. motors instead of A. C. motors. The motor generator control panel will have a D. C. motor starting rheostat instead of the starting compensator and a line switch suitable for the voltage. What has been said about distributing panels and charging rheostats applies also in this case.

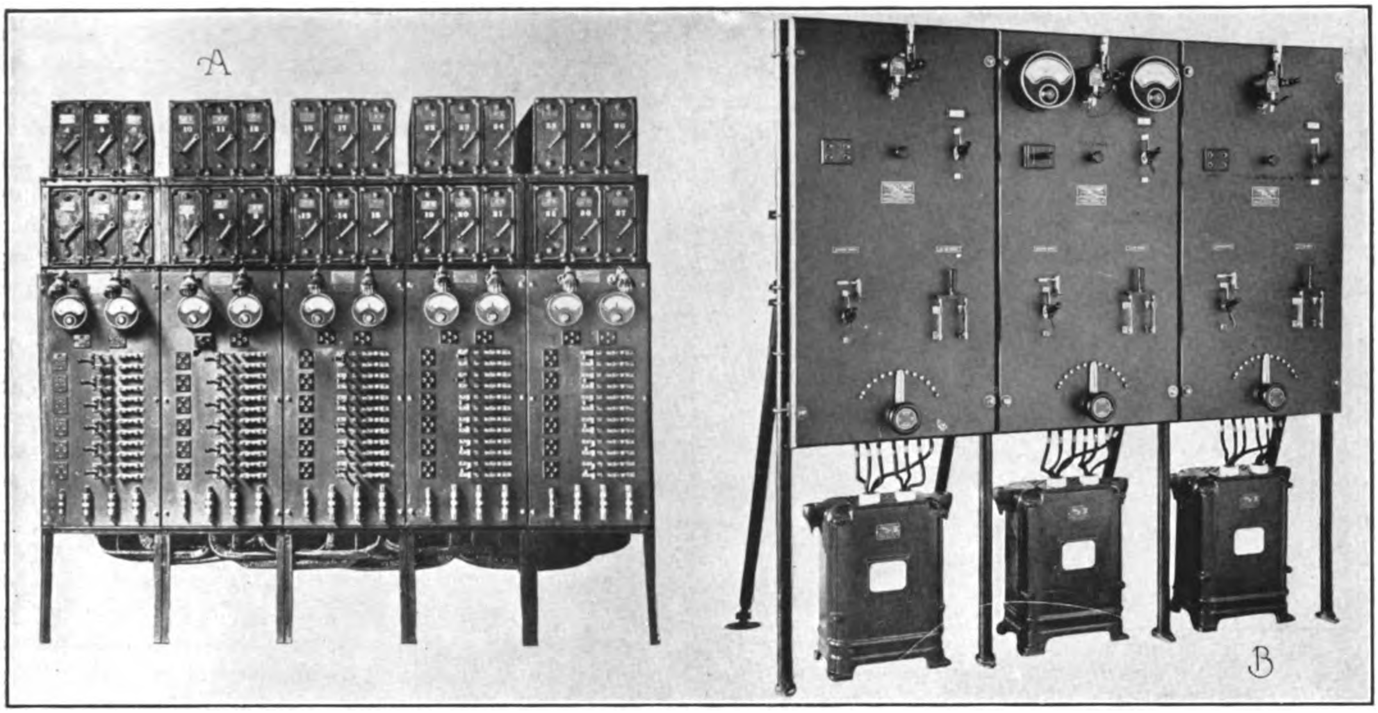
In case it were necessary to charge a high voltage battery of, say, 48 cells lead, it would be connected to the 220-volt supply with sufficient rheostats in series, making it unnecessary to boost the voltage of the generator for one or two batteries,

In these three comparisons it is assumed that other conditions are the same; that is, one is as reliable as the other. If one current cannot be relied upon for continuous service when it would be needed, the other should be taken almost regardless of the cost, particularly in a public garage where failure to charge a battery may result in losing customers or, at least, dissatisfaction.

There are some advocates of the so-called "multi-voltage system" of charging. The idea in this scheme is to reduce the losses in charging rheostats by having generators of different voltages for the different voltage batteries. The scheme is considered impractical by many on account of high first cost, skilled attendants necessary, and the doubtful saving accomplished, all things considered. If such a system were adopted it would be almost impossible to estimate the capacity of each generator of a different voltage. For example, a garage might have 10 24-cell batteries at the time of ordering a generator to charge them and in six months' time they might all be gone. The tendency now seems toward the standardization of the 30-cell battery for pleasure and 40-44 cells for commercial cars. A double-voltage system consisting of an 80-volt generator for 30 lead cells (40 cells Edison) and a 110-volt for 40 lead cells (60 Edison) in many cases will be a simple and economical arrangement. Mercury arc rectifiers in a garage of course constitute a multi-voltage system of units, but as each rectifier will operate efficiently at any charging voltage it cannot have the objections cited above.

The Department Store Garage.

The cars of any up-to-date electric delivery system are usually uniform in the number of cells of battery they contain



Modern Garage Charging Equipment: A, Public Garage Switchboard Fitted with Battery Charging Rheostats; B, Commercial Vehicle Type Rectifier.

causing a great waste on all the other circuits.

Five Hundred to 600 Volts D. C.—The public garage having 500 to 600 volts only available would use a similar equipment to that having 220-250 volts D. C., except that the motor, line switch on the control panel, voltmeter, starting rheostat and wiring would be arranged for the higher voltage.

If the 500 or 600-volt circuit is from a trolley line and varies as such circuits often do from 300 to 600 volts, it would be well to choose another circuit if available. If it must be used the generator of the motor generator set should be specially designed to give approximately full voltage at about one-half speed and a generator voltage regulator installed to hold a fairly constant voltage on the generator.

General.

Some garages may have both A. C. and D. C., in which case the rates a kilowatt-hour may decide which supply is the better to adopt. The following is suggested:

With both A. C. and 110 to 125 volts D. C., the latter is unquestionably the one to use if the costs a kilowatt-hour are anywhere near the same. If A. C. were five cents and D. C. eight cents a kilowatt-hour the large garage would probably use enough current to pay the interest and depreciation on the greater investment and save money by using the A. C. and converting it to D. C. with a motor generator set.

With both A. C. and 220 volts D. C. there would not be much choice and the current carrying the lower rate a kilowatt-hour should be used.

With both A. C. and 500 volts D. C., there is not much choice in the public garage, but in the private garage the A. C. would be safer. Otherwise the current that can be bought at the lowest rate should be used.

and in the number of cells of batteries which are generally of 40-44 cells (or the equivalent in Edison), so that they can be efficiently charged from the 110 to 125-volt D. C. service usually found in the business sections of large cities. Further, all cars as a rule come into the garage at about the same time.

All these facts make it possible to design a very efficient charging equipment; there is little loss in rheostats; the charge can be started on all cars at once, so that if a motor generator set is used it can be operated at nearly full load. Besides it is not difficult to estimate future requirements.

The remarks already made with reference to charging apparatus for various A. C. and D. C. supply circuits apply to this style of garage the same as to others. Arrangements must be made to take care of a small charging load in the day time for forming batteries, etc.; if high current boosting is required at noon, heavy circuits to handle the current must be installed and the generator equipment must be carefully estimated.

If due consideration is given to all conditions it is possible to make this operate more efficiently than any public garage.

Charging Edison Storage Batteries in Public Garages.

The garaging of cars containing Edison batteries introduces some additional complications in the design of charging apparatus which have to be considered if a garage expects to care for them under all conditions.

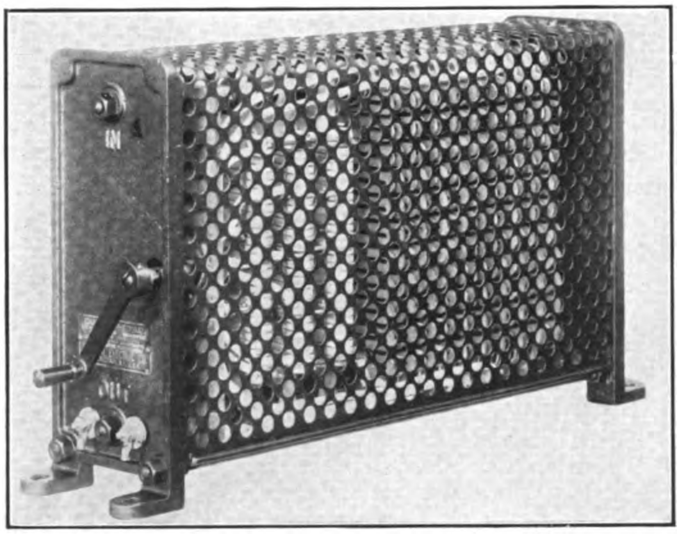
The makers of this battery allow charging rates greatly in excess of the normal rate. For example: An Edison A-8 battery (normal charge for seven hours at 60 amperes) may be charged for 30 minutes at three times normal, 180 amperes, or for 15 minutes at 300 amperes. The maximum voltage under these conditions will be higher than normal, necessitating a higher charging voltage from the generator or D. C. supply.

At three times normal charge rate the maximum D. C. voltage required would be about 1.98 volts a cell, or for a 60-cell battery about 119 volts (normal 111 volts). This battery could not be boosted at much over the normal rate from a 115-volt D. C. circuit. To accomplish this overcharging it will be necessary to boost the voltage of the D. C. circuit to about 125 volts or preferably to 135 in order to take care of any voltage drop in the charging circuit. The voltage may be boosted by connecting a low voltage generator in series with the D. C. circuit. This generator should be capable of delivering about 20 to 25 volts, depending on the boost required, and should be driven by a suitable size 115-volt D. C. motor. Full information on the proper equipment to use can be ascertained from manufacturers of electric motors and generators who are always glad to give the benefit of their experience to prospective purchasers.

The garage of the department store, express or delivery service company using Edison batteries in their vehicles must first see to it that their cars are equipped with heavy circuit and charging cable, plugs, etc., if the "noon hour boost" is to be adopted, or there may be danger from fire due to heating caused by high current.

Special high current or heavy duty charging plugs which will safely carry 200 amperes can be purchased. If the cars are equipped with ordinary 50 to 60-ampere plugs, they should be replaced by these heavy duty plugs before overcharging is practised to any extent.

The generator capacity of such a garage, if motor generator sets are used, must be carefully considered. If all cars are to be boosted at triple rate for 30 minutes, and normal load on the generator represents normal charging rate of all the batteries at one time, it means a 200 per cent. overload on the generator, which is more than it is designed to stand, and a generator of equal capacity should be connected in parallel with it. This generator will also serve as a spare in case of trouble with the other. Of course if only a part of the batteries



Standard Type Battery Charging Rheostat.

are to be boosted the original generator will probably be of sufficient size to handle these batteries.

If such boosting is to be done a sufficient number of extra heavy duty distributing panels, with higher capacity wiring, switches, fuses, heavy duty outlets, etc., should be installed.

Increasing Capacity.

The charging capacity of a public garage can be materially increased, if the hours for charging are lengthened. If a garage keeps a charging operator on duty all night, which is often necessary anyway, three groups of car batteries may be charged from 6 in the evening to 6 or 8 in the morning. Many cars are not used after 6 in the evening and these will start the first group. The second group will begin to come in about 8 and by 10 many of the first group will be charged, so the second group can be started. A third or after-theatre group may be started about 2 in the morning, and all the charging finished by 6 or 8 at the latest. By carefully analyzing conditions of this kind in a garage and insisting upon a certain routine arrangement being followed, a maximum charging efficiency can be obtained and maintained. In this connection it will pay to have in charge of the charging apparatus a man with some knowledge of the savings possible by judicious management, even at a much higher salary.

A great deal more could be said on this subject of charging apparatus, as this paper has dwelt only on generalities and left the details for each garage manager to figure out for himself. As already stated, manufacturers of charging equipments are glad to make suggestions to intending purchasers if requested. In making requests the more complete the information given the more complete will be the suggestions.

The following questions bear vitally on the subject:

(A) Nature of Supply.

1—Alternating or direct current?..............................
2—Frequency (if alternating).......Cycles? No. phases?.......
3—If both A. C. and D. C. available,
give rate on each (alternating.........cents per kw.-hr.
(direct .... " " "
4—Voltages available? (alternating.................... volts
(direct......................... "
5—Approximate percentage fluctuation in voltage? (alternating...................... %
(direct............................ %
6—Remarks ....

(B) Charging Information.

7—Will charging operators be on duty day and night?
8—Number of cells, type and charging rates of batteries?
Number of batteries?
Average hours charging required per charge?
Normal charging rate (Amperes start?
(Amperes finish?
(Time hours?
Overcharge and how long required (Hours? Amperes?
Maximum number of cars to charge at one time?
Minimum " " " " " " "
9—Charging apparatus installed at present time?

INTER-CITY TRUCK SERVICE.

Freight Haulage Between Baltimore and Washington Promoted by Business Men.

The railroad companies entering Baltimore and Washington have decided to discontinue the free store-door delivery that has been the vogue in those cities for a long period, and this has been the means of promoting a motor truck freight service between them. The project has been inquired into by several organizations of business men and has been approved by them. A well established Baltimore company is willing to operate the line as soon as it has the assurance of sufficient business to justify the use of two six-ton trucks.

It is expected that a large number of firms that have no delivery equipment and have shipments made from the one city to the other will support the service, as this will give them every convenience desired and at practically the same expense. The saving in time and the delivery at the stores are expected to be factors that will appeal to a large number, and the cost will not, it is believed, be as much as the railroad freightage and delivery charges combined.

L. R. Smith has been elected president of the A. O. Smith Company, Milwaukee, Wis., succeeding his father, A. O. Smith, who died a few months ago, and he will continue as general manager of the concern. Mr. Smith has been identified with the company for years. The other officers are: Vice president, C. S. Smith; secretary, E. M. Smith; treasurer and assistant secretary, James L. Sinyard; assistant treasurer, Joseph J. Stamm; sales manager, James L. Sinyard; directors, L. R. Smith, C. S. Smith, E. M. Smith, James L. Sinyard and John P. Kelley.

The Firestone Tire & Rubber Company, Akron, O., during the fiscal year ending July 31, earned in gross figures approximately $15,000,000; the net profits were $1,600,000 and the surplus was $1,250,000. The net assets of the company of that date were about $7,000,000. The earnings for the year showed an increase of $3,500,000 as compared with the previous year.

SPEED AND DISTANCE MEASURING DEVICES.

By G. F. Matteson.

AFTER exhaustive laboratory tests and practical tests on the road of various forms of speed measuring devices, it was clearly demonstrated that those forms which depended on springs, magnets and delicate mechanical parts would not retain their accuracy for any considerable time and the liquid centrifugal principle was found to be the most accurate and reliable and was, therefore, incorporated in the Veeder tachodometer, Fig. 1, which is a combination of an odometer or distance recorder and a tachometer or speed indicator.

The case contains a colored liquid, which is forced up the glass tube by a paddle wheel attached to a vertical shaft whose speed varies with the speed of the car, being positively driven by a flexible shaft connected to the front wheel. The paddle is double, the lower part being approximately twice the diameter of the upper. The flow of liquid is generally controlled by the larger wheel and the speed is indicated by the height of the liquid and measured by the scale on the right of the tube. This scale is usually graduated to 30 miles. This will be found to be sufficiently high for all ordinary traffic, as few automobiles are driven over 30 miles an hour in actual practise. In order to provide for registering higher speeds a scale reading to 60 miles an hour is provided on the left. A small lever at the right of the instrument operates a two-way valve which directs the flow of liquid to the indicator tube from the larger paddle when the 30-mile scale is used or from the smaller paddle when the 60-mile scale is used.

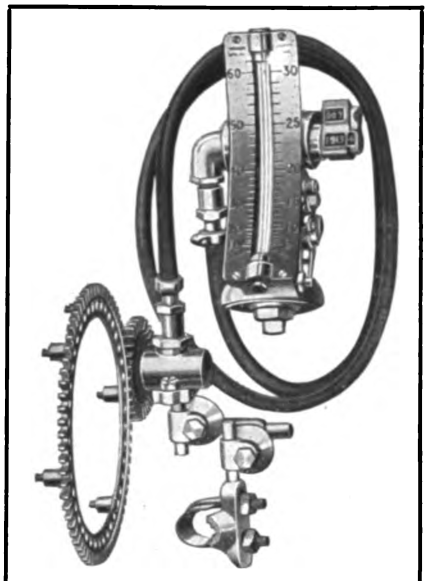


Fig. 1—The Veeder Tachodometer.

The column of liquid is adjusted to the zero graduation when the car is stationary by means of a float within the case, operated by a thumb wheel at the lower right hand side of the case. Ball bearings are provided throughout and all parts are strongly and durably made.

The upper line of figures of the odometer records the miles and the tenths of miles for each trip and may be set back to zero at will.

The lower line of figures records the total miles which the instrument has run and cannot be set back.

While centrifugal speed indicators have an average error of three to five per cent. and magnetic controlled speed indicators have average errors of over 10 per cent., the Veeder tachodometer is guaranteed within one per cent. of error and its accuracy is not affected by vibration, variation in temperature or ordinary wear.

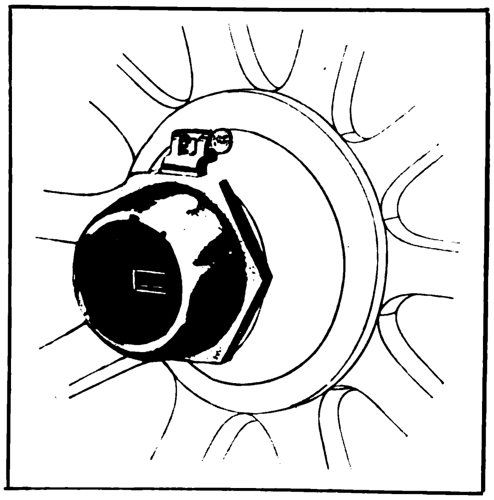


Fig. 2—The Veeder Hub Odometer.

The form D odometer, Fig. 3, is a very popular instrument, which is attached to the dashboard and is operated by a flexible shaft driven by a gear attached to the front wheel. The instrument measures miles and tenths of miles. The three-figure trip register can be set back, but the five-ring register, which records the total mileage, cannot be set back.

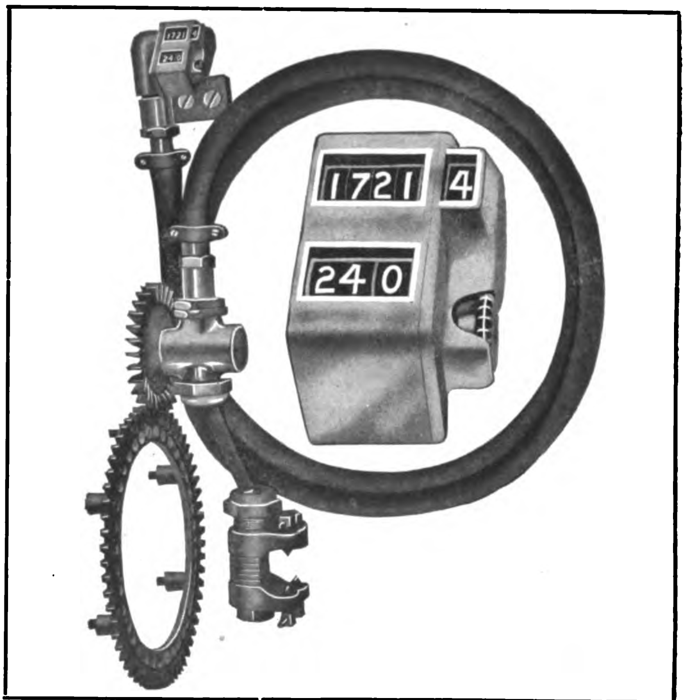


Fig. 3—The Veeder Form D Odometer.

The Veeder hub odometer, Fig. 2, is a most compact mileage register which is attached to the hub of the front wheel in place of the regular hub cap. It is

operated by means of a slot in the end of the front axle engaging with pins attached to a flexible and pressure equalizing mechanism which positively drives the register which indicates miles and tenths of miles.

One type is made so that it will register the total mileage both forward and backward. Another type is made so that it will register only the mileage forward. After attachment to the wheel hub these instruments are sealed so that they cannot be tampered with, thus providing a true record of mileage.

BAKER TRUCK TO TEST TIRES.

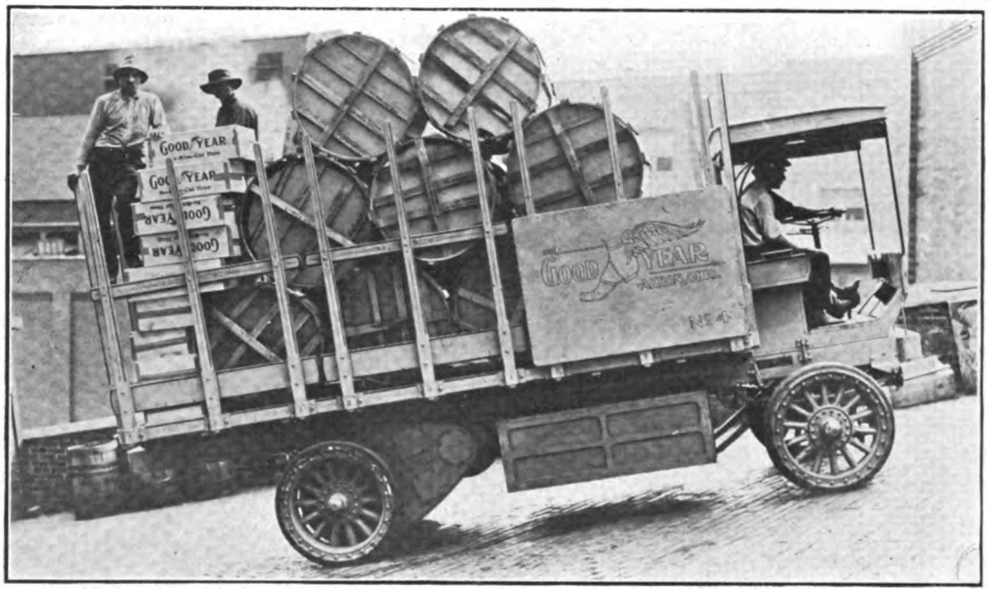
Goodyear Company Utilizes Standard Machine to Develop Special Products.

The Goodyear Tire & Rubber Company, Akron, O., has in its service a 3.5-ton Baker electric truck that was recently delivered and is used for a decidedly novel purpose. As is well known, some of the manufacturers of solid rubber tires have found a demand for shoes that will have high resiliency and yet at the same time endure under practically all classes of work that is practicable with machines. There is a decided difference between the tires that afford the best results with electric and gasoline vehicles. The main object to be obtained by electric truck builders is to minimize the current consumption, with a view of obtaining maximum mileage on the normal battery charge, and careful experiments have developed the fact that the higher the resiliency the less the demand upon the battery.

There is, however, a critical point in resiliency, in that when this has been exceeded the tire will not endure as well, and so the endeavors of the experimental departments of the tire manufacturers referred to are devoted to determination of what compounds will produce both qualities to the highest degree. To obtain definite data it has been necessary to take tires made from different compounds and use them in service that will demonstrate both current consumption and endurance, working them as nearly as can be judged they will be used by owners.

The Baker truck is used as a testing machine to measure the efficiency of all types of Goodyear tires in actual use, and this is done in work between the Goodyear plant and the various railroad terminals, and in exacting tests over the courses selected for observations for resiliency and battery current consumption. The truck is equipped with two sets of wheels, so that tires may be adjusted on one set while the other is in use, and the time of changing minimized.

The possibilities of obtaining satisfactory data with the truck are very large, and according to engineers who have carefully studied tire testing the only certain figures are those that have been made with recording instruments. These can be applied to an electric vehicle and accurate readings obtained, from which charts may be plotted and comparisons made that will show differences very exactly. These records would be extremely costly were they not made in connection with the work of the factory, and by the use of the machine the company is making regular work produce a double result, and in this particular case the electric truck is an unusual economy.



Baker 3.5-Ton Truck, Used by the Goodyear Tire & Rubber Company for Testing Tires, Ascending Steep Grade During Regular Service.

The truck was delivered from the Baker factory in Cleveland, O., to the Goodyear plant in Akron, a distance of 42 miles, under its own power. After arrival the truck was taken about the city by some of the officials of the Goodyear company and driven several miles, during which it ascended Borth hill, one of the longest and steepest grades in Ohio, and at the conclusion of the trial there was sufficient current remaining in the battery to drive several miles. The accompanying illustration shows the truck and a load ascending a very steep grade in its regular work.

The Beaver State Motor Company has been organized at Gresham, Ore., by Gresham and Portland interests. A factory is to be built and the company will begin the production of motor trucks on a small scale.

The International Motor Company has inaugurated a new selling policy in which the customer who pays cash may receive a discount of six per cent. from the regular list price, or may pay a quarter of the value and the remainder in 12 equal monthly installments.

KNOX-MARTIN TRACTOR IN HEAVY HAULAGE.

Replaces Fourteen Horses in Lumber Work at Average Daily Cost of $12.50--In Coal Delivery It Supplants Six Horses at an Expense of $12.

DOING the work of 14 horses, the Knox-Martin tractor, owned by Ellis & Eaton, Stafford Springs, Conn., is hauling undressed lumber out of the woods to the mill of the Levi P. Bridges Company, Hazardville, at an average daily expense of $12.50. This figure not only includes the maintenance of the machine, but the wages of the driver, two men and a boy.

Ellis & Eaton operates a steam sawmill in the woods at Orcuttville, the wood lot being about 2.5 miles from Stafford Springs and some 12 miles from the Bridges plant in Hazardville. The tractor leaves the barn in Stafford Springs each morning, makes two trips from the wood lot to Hazardville, and returns direct from Hazardville to Stafford Springs at night. The daily mileage is therefore a little better than 50.

The road leading from the sawmill, for the first quarter-mile, is composed almost entirely of sawdust and slabs. Then follows about 1.5 miles of dirt, varying from decidedly poor to very good. This leads onto a state road, which is followed all the way into Hazardville. The route lies over a long hill, which is somewhat steep in places, and offers a grade for nearly three miles, although of course, this is not all hill. The tractor takes this on the down grade, when loaded.

Those who are familiar with the construction of the Knox-Martin tractor, made by the Knox Automobile Company, Springfield, Mass., are aware that it presents a three-wheeled construction, the two rear wheels, or the traction members, virtually being the forward wheels of the trailer. The tractor is so designed that, while it may readily be detached from the trailer, when it is attached the combination really becomes a five-wheeled vehicle. As such it takes up no more space than a wagon and a pair of horses, and can be turned in the same radius. This feature is of importance when considering work in the woods.

In view of the fact that Ellis & Eaton contemplated using the tractor in hauling from 5500 to 7500 feet of lumber at a load, the weight of which averages about 1.66 tons to the 1000 feet, according to experienced lumber men, and considering the class of roads over which it was to be operated a portion of the time, the trailer was of special construction. By this is meant that the rear springs and axle were built to carry the loads and withstand the stresses. The extreme rear wheels are of double construction, with two heavy steel tires and two sets of steel spokes radiating from a common steel hub.

It will be seen that the tractor is called upon to haul from 9000 to 12,500 pounds to the load, assuming that the weight estimate given is correct. Two trips are made daily, so that the loaded mileage is approximately 24 miles. The heaviest grade is surmounted in the reverse direction, and this occurs but once each day. The tractor uses about 15 gallons of gasoline a day and about a gallon of lubricant a week.

The items in the expense account going to make up the daily charge of $12.50, include, besides the gasoline and oil, the wage of the driver, $2.25 a day; two men at $1.75 a day and a boy at $1.25. No allowance is made for garaging the vehicle, since it is kept in a building which is available for no other purpose. There has been no expense for repairs as yet, but the total is held to include an allowance for depreciation and interest. The two men are employed in loading the lumber, but do other work in the interim, and it certainly would be fair to include only a portion of their wages. The boy accompanies the driver on the tractor and assists in unloading at the Bridges mill. No provision is made for quick loading or unloading.

The front wheel of the tractor is shod with solid

Knox-Martin Tractor and Heavy Duty Trailer in Service with Ellis & Eaton, Stafford Springs, Conn.

rubber, while block tires are used on the traction members. The truck has not been in service sufficiently long to determine the life of these tires, so it is impossible to do more than estimate the mileage cost on these. If it shall transpire that this estimate has been placed too low, it undoubtedly will be found that this will tend to even up any overcharge that may have been credited to the two men who assist in loading in the woods.

In the beginning it was stated that the tractor was doing the work of 14 horses. By this is meant that it is doing the work that 14 horses could do. No such number of horses has been replaced. When pressed for comparative figures the man in charge of the tractor was unable to give more than an estimate for horses. This was largely due to the fact that Ellis & Eaton has a large farm on which is raised the hay and some of the other products consumed by its horses.

It is contended that there is no way of determining exactly what these products cost the firm, therefore it is impossible to judge exactly what the horse equipment has cost. It may also be pointed out that the expense of caring for the tractor is not as great as would be the case were it to be maintained by a concern in the city. The man in charge is a capable mechanic and spends much of his time in caring for the machine, taking deep interest in it and seeing that it is driven carefully at all times.

There is one feature in connection with the use of a Knox-Martin tractor which is of special interest to the investigator. When the inventor, Charles H. Martin, was about to place the vehicle on the market, through the Knox company, he maintained that it would prove decidedly economical on tires, for the reason that it would be found possible to use steel on all except the front wheel. Ellis & Eaton considered this phase of the situation, but early came to the conclusion that it would not be practical to use steel tires on the traction

The Ellis & Eaton Installation with Light Load of Lumber—Note Difference Between This Improvised Horse Wagon Trailer and That Specially Designed for Heavy Loads.

members. This decision was reached because of the character of the roads in the woods, the surface being composed of sawdust and slabs, as previously explained, and over that portion by which the state road is reached. However, if continued experience bears out the results of the first three months of service there seems little reason for complaint on that score.

But if Ellis & Eaton is unable to give information concerning the use of a Knox-Martin tractor utilizing steel tires on the traction members, it is possible to secure reliable data by considering the installation used by the M. S. Converse Company of Springfield, Mass. This concern is engaged in the retail coal business and has been using a Knox-Martin tractor for the past 15 months. In this instance, steel tires are used on all four wheels under the trailer, the front wheel only being shod with solid rubber. This statement needs a little amplification, however.

Springfield is plentifully supplied with hills, and as true of all progressive cities, many of these hilly streets are paved. The tractor is called upon to haul loads ranging from five to nine tons, although the latter figure is attained only at intervals. The experience of the early part of last winter was such that it was indicated that the best results could not be obtained on these paved hilly streets with steel tires on the traction wheels. Accordingly, block tires were substituted, but only during the winter months, when the streets were coated with snow and ice.

As with the Ellis & Eaton installation, it was found desirable to secure a wagon body of special design. This is entirely of steel, with flaring sides and ends, so that the coal is carried toward the centre by gravity, when the slide at the side is opened. It should be stated that much of the coal delivered to families in Springfield is carried from the wagon to the house in baskets, or bags. This factor is of importance, since it has been found advisable to work the tractor with two and three men beside the driver.

This machine is used on what is termed the long haul work and does the work of three two-horse teams. The Converse company delivers coal in Springfield, West Springfield, Chicopee, Longmeadow and East Longmeadow. Sometimes it is called upon to extend its deliveries to Indian Orchard, but this is very seldom. If it is so fortunate as to secure the contract for supplying the city schools, this contract will include the Indian Orchard district, that suburb being a part of the city proper, although five miles from Court square. Longmeadow, East Longmeadow and Chicopee are each about four miles distant, while West Springfield is a matter of one mile. It will be understood that these distances are computed from the centre of the respective towns and cities.

The tractor averages about 35 miles a day, winter and summer, for deliveries are made throughout the year so far as possible. The photograph reproduced herewith was taken when the machine was about to leave the yards of the company with nine tons of coal. It is explained that the wagon body holds five tons, and the additional four tons are represented by the bags on top.

The daily fuel consumption is about 10 gallons. It will be seen that this is very close to the experience of Ellis & Eaton. The latter concern covers 50 miles a day on 15 gallons, while the Converse company uses 10 gallons in travelling 35 miles a day. In one instance the consumption is 3.3 miles to the gallon and in the other 3.5. The other conditions are practically the same, excepting of course, the matter of tires. The Converse company finds that the tractor has a daily

maintenance expense of about $12, this including the wages of two to three men and the driver.

It readily will be conceded that the daily cost of operating the tractor would be reduced very materially if it were not necessary to employ so many men. It has been explained that the body has been designed to unload from the side by gravity. Were it possible to drive the machine alongside the coal hole and dump the load, as is the custom in many cities, there would be little occasion for the services of but one man, and that the driver. This would eliminate the wages of from two to three men, and cut down that daily expense accordingly.

The Converse company loads its truck from a chute leading from the coal pockets. There is practically no delay in this respect. The unfortunate custom, requiring that coal shall be delivered in baskets, makes necessary the employment of additional men, the number depending upon the distance from the road to the window leading to the coal bin, in order to cut down the waiting time at the other end. Of course, the design of the wagon aids very materially in unloading, since it is the work of but a brief instant to open the slide and fill a basket.

These two installations indicate the economy and efficiency that can be secured through the use of a Knox-Martin tractor. In some respects the Ellis & Eaton work offers conditions that might be regarded as severe from a tractive viewpoint, while the Converse situation presents difficulties in the way of eliminating time. Both concerns are confident that the tractor solves their respective problems in the most satisfactory manner. That this opinion is held by others in the latter case seems evident from the fact that another coal concern in Springfield has placed a duplicate of the Converse equipment in service within the past month or six weeks.

After building gasoline and electric motorettes for a considerable length of time at Hartford, Conn., C. W. Kelsey, who was the head of the Kelsey Manufacturing Company, and later of the C. W. Kelsey Company, has discontinued manufacturing and has retired temporarily from the industry.

The George Grow Automobile Company, dealer in used pleasure cars and service wagons, has removed from Worcester street to the Electric Garage, 331-33 Columbus avenue, Boston, Mass., where it occupies the entire building.

ISSUES NEW BEARING DATA.

J. S. Bretz Company, Importer, Is Mailing New List to the Trade.

The J. S. Bretz Company, 250 West 54th street, New York City, sole importer of the F & S annular ball bearings, is mailing the trade a new booklet which cancels all previous lists relative to the product handled by this concern. The various types are illustrated, including the light, medium and heavy series, also the narrow types, and dimension diagrams are presented. Each bearing is listed, giving the outer diameter, bore and width, ball diameter and number of balls. The load-pounds given are the highest proper for steady loads and speeds.

The dimensions are given in millimeters, but a table of inch equivalents is included, making it a simple matter to convert the measure. Special tables will

Knox-Martin Tractor Loaded with Nine Tons of Coal in Service with M. S. Converse Company, Springfield, Mass.

be supplied on request for other speeds and loads, and for extra sizes where their use is indicated. The single annular type fitted with the narrow ribbon ball separator and the W. H. narrow width ball separator are well known to the trade and the data on these will be of service to the garage, repairman and service station, as sizes and prices have been revised to Sept. 1.

The use of motor trucks by large manufacturers on long distance deliveries has become a custom and the Walker & Pratt Manufacturing Company of Watertown, Mass., is sending four Mack machines over the road to Lynn, Haverhill, Lawrence, Lowell and other New England cities, each loaded with three tons of stoves for local dealers. The Mack trucks have been in constant use by the company for the past 12 months and according to Sales Manager Stevens, without trucks for quick delivery, its business would be greatly handicapped.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA.

The Objects of the Organization, and How the Practical Use of a Well Established Utility Has Been Systematically Advanced Among Business Men.

By Frank W. Smith, Vice President.

THE Electric Vehicle Association of America at the conclusion of its fourth annual convention, to be held in Chicago, Oct. 27-28, will enter upon its fourth year of existence. The first year's work was largely of a formative nature, although much was done during this period to cement and bring together the several factors interested in the promotion and adoption of the electric vehicle, for which purpose the association was formed. Three years of activity finds the association in a very flourishing condition and the incoming administration should look forward with great encouragement for bigger and greater things to be done for the interests for which the association stands.

Frank W. Smith, Vice President Electric Vehicle Association of America.

The membership has steadily increased from year to year until today it numbers within its several grades of membership—active, auxiliary, associate and press—some 430 members. There has been an increase in the membership during the past year of 35 per cent., notwithstanding that some 25 members have dropped from the roll, principally because of discontinuing their activities in the electric vehicle field.

This increase in membership is a most favorable indication and emphasizes the fact that the scope of the association's work is continually broadening. Of especial significance is the fact that foreign influence has been created by the association. New members have been secured from Berlin, London, the Philippine Islands and Canada, with an interesting inquiry as to associate membership from Brazil. So that the association may be said to be of international as well as national influence.

The individual owner of the electric vehicle and the garage owner have not, so far, been included in any great numbers among the membership. No especial appeal has been made to this class. With the growth and larger influence of the association membership within this field can be successfully appealed to.

With the increase in membership and the expansion of the electric vehicle business the experience of important societies, such as the National Electric Light Association, will probably be repeated in the case of the Electric Vehicle Association; that is, the necessity for team work of committees. A quotation from the September bulletin of the National Electric Light Association will serve to emphasize this point:

With the development of committee work of the association have gone the perception and acceptance of the principle that while leadership is ever desirable, what the industry really needs is not simply the expression of individual opinion, but data collected over the whole area and the ripest judgment in its interpretation. Hence, in the affairs of this great body, the committee looms up more and more in authority, and the committee report more and more embodies and enforces the practices that have the largest adoption.

According to figures published at the first of the current year there were some 35,000 electric vehicles registered throughout the several states of the Union. During 1912 8756 vehicles of the passenger and commercial type were manufactured, the output for that year representing nearly one-third of the total electric vehicles under registration; the percentage of increase showing for 1912, 42 per cent. for the passenger and 34 per cent. for the commercial. An output of 15,000 electric vehicles for the year now drawing to a close has been predicted by some authorities, and a census of the 1913 figures will indicate as to whether or not these predictions are to be fulfilled. Certain it is that the electric vehicle industry stands today on the commercial horizon as a potential factor in city and suburban haulage, and that its future is well assured.

That the Electric Vehicle Association has been, at least to some extent, a factor in this development, is conceded in many quarters. That its influence can be broadened and made of greater benefit to the industry as a whole may well be predicted. To this end, important work through the coming year will devolve upon the several committees whose activities are to be looked forward to with great expectations.

Publicity Campaign.

An important branch is that of the publicity committee whose work through the past year will be set forth in its report to be presented before the Chicago convention.

The co-operative educational campaign for the first year came to a conclusion about Aug. 1 last. In this campaign there were a total of 451 separate advertisements inserted throughout the magazines in the several groups of mediums employed. The total cost of the campaign, including all items of expense—advertising, mechanical charges covering drawings, setups, electrotypes, mechanical work, postage and miscellaneous—was slightly over $41,000.

Inquiries were received as a result of this advertising from almost every corner of the globe, and while

the copy was of a general educational character and was not designed to secure replies or definite leads, there were upwards of 2000 inquiries about equally divided as between passenger and commercial vehicles.

In the early spring the advertising committee proceeded to solicit contributions to a fund which would make it possible to carry on the publicity work for another year. The committee reports that to date some $35,000 has been obtained, and it is hoped to increase this fund by at least $10,000 within the next few months. This can only be accomplished, however, by hearty response to the committee's appeal to those interested in the promotion of the electric vehicle who have not so far subscribed to the fund.

The 1913-14 campaign, which will be inaugurated about Nov. 1, will include copy of a somewhat different nature than that heretofore used, being more intensive or specific and not of such a general or educational character as during the first year.

Two booklets will be published by the committee, one "The Story of the Electric Pleasure Vehicle," and the other, "The Story of the Electric Commercial Vehicle." They will be 24 and 32 pages respectively.

The covers will be of the poster effect, original in design and in three colors. The booklets will be printed throughout in two colors, profusely illustrated with different types of cars in various settings, and will contain, as well, actual photographs of the newest models of the manufacturers, with a brief description of the vehicles; only those manufacturers being included who have contributed to the publicity campaign.

The editorial matter takes up the early history of the electric, its reliability, cost of maintenance and an explanation in non-technical terms, with accompanying illustrations of its simplicity and durability.

Artistically printed and well written, these booklets, the committee believes, will be found to influence those who are considering the purchase of an electric vehicle. Each piece of advertising copy will "play up" to these booklets and they will be sent in response to the inquiries which come to the association as a result of the advertising, the inquiries to be followed closely from the secretary's office, with whom the manufacturers will be put in touch.

The committee hopes to interest central station companies, and others, the purchase of these booklets to be included within their advertising literature. The booklets will not be sold with the idea of making a profit on their sale, but at cost, in order to increase the circulation, and thereby add to the general publicity of the association's campaign. Sample copies may be had at 25 cents each upon request to the committee.

Committee on Rates and Charging Stations.

The report of the committee on rates and charging stations, of which John F. Gilchrist, Chicago, is the chairman, has covered the subject for which his committee is responsible in a very exhaustive outline of the situation. Much has been done, as indicated by this report, by the central station companies throughout the country to standardize rates for charging current, and the report indicates a general tendency downward for this character of service.

The report presents a great amount of detail in tabular form and shows, among other items, the rates a kilowatt-hour earned by private and public garages; the number of these garages and charging stations throughout the country, with the cost to the public for the service which they render; the number of electric vehicles reported in each city and the approximate percentage of increase during the past two years, and, finally, a list of central station companies which have reported the number of electric vehicles owned by them, their garaging facilities also being indicated. Curves and other data make the report a most complete and exhaustive one, which will be very helpful to the electric vehicle industry at large.

Insurance Committee.

This committee during the year 1912 was successful in securing a 10 per cent. differential in the rate on liability insurance for electric vehicles over other forms of motor driven cars, and during the past year has secured from one of the best New England companies a further 10 per cent. reduction, or practically 20 per cent. from the standard rates for gasoline driven automobiles and trucks for liability insurance.

Among the other committees are the educational, standardization, operating, records, garage and legislative. The activities of these committees throughout the past year on behalf of the association will be set forth in detail in their respective reports which will be submitted at the coming convention.

Association Sections.

The Chicago and Boston sections of the association have been very active during the year, have held regular meetings, where papers and important topics have been presented and discussed, all for the benefit of the industry. It is expected that a report from the chairman of each section will be submitted at Chicago, where the work throughout the year will be reviewed.

Electric Motor Car Club of Boston.

In addition to the New England Section of the Electric Vehicle Association, there is co-operating therewith the Electric Motor Car Club of Boston, with a membership of approximately 120, comprised of the various local interests identified with the industry.

Prominent in the activities of this club is the employment of a business secretary, devoting his entire time to the exploitation of the electric vehicle along the line of working up newspaper advertising, also assisting the standing committees of both the club and section in the conduct of their work. An up-to-date list of all charging stations, together with a list of electric vehicle owners throughout New England, is also kept by this business secretary.

The excellent work of the Electric Motor Car Club in conjunction with the New England Section has without doubt been of material assistance in the very handsome increase in the sale of electric vehicles in New England during the past year.

A word of commendation should be said of the

splendid work which is being done by the central station and automobile trade journals in publicity for the electric vehicle proposition. Those who follow these publications and read the editorials and articles cannot help but be impressed with the marked attention that is being paid to the electric vehicle as compared with even a year ago. This is a sure indication that the subject is one of very great general interest and that the electric vehicle is today not "coming into its own", but "has arrived."

NEED OF DELIVERY EQUIPMENT.

First Purchase After a Fire Was That of a Motor Vehicle.

The necessity of satisfactory delivery is most keenly realized when such service is developed and it is terminated by the destruction of its equipment. This was the experience of the Cream City Bedding Company, Milwaukee, Wis., recently, when a fire happened that greatly damaged its plant. Quite as necessary as stock was the means of delivery, and within a few minutes after the beginning of business the company bought a KisselKar delivery wagon to replace one lost in the flames, and then the management turned toward securing a stock with which to serve its customers. In this instance the company bought a vehicle like that it had used, being sufficiently satisfied to make no change in its equipment.

A Knox-Martin Tractor and Its Load of 18 Tons of Sand, This Being One of the Largest Road Vehicles in Regular Service.

INTERURBAN FREIGHT HAULAGE.

Improved Road Construction Establishes an Increased Market for Motor Vehicles.

John N. Willys, president of the Garford Company, maker of Garford trucks, is of the opinion that with the very great sentiment in favor of good highway construction, and the willingness of the national, state and municipal governments to build roads that will endure, interurban truck transportation service will be very quickly developed. He believes that there will be great economy as compared with railroad and other carriers, and that with the saving in time as well, the patronage will be constant and proportionate to the service afforded the people. Mr. Willys maintains that wherever a new road is built it establishes a market for motor vehicles, and practically benefits the community to a degree that is little realized.

BIG CONSTRUCTION FUND PLEDGED.

More Than Half of Needed Sum Is Available for Lincoln Highway.

Pledges of more than $5,000,000 have been made thus far to the construction fund now being raised to build the Lincoln memorial highway from New York to San Francisco, according to the treasurer of the Lincoln Highway Association. There is one contribution of $300,000 and the donations range down to very small amounts. The purpose of the association is to raise the $10,000,000 estimated necessary for the work before construction is begun, and to accomplish this the association has created state organizations and sectional and municipal committees to solicit funds and stimulate interest.

A large number of motoring clubs and associations, as well as commercial and industrial bodies, have taken active part in the preliminary work, and it is proposed to interest makers of vehicles, road making machinery and materials, and others who might tangibly benefit from the example of these individuals and concerns. It is expected that a considerable part of the fund will eventually be contributed by farmers and agricultural interests. In the work to be done in Colorado a considerable number of convicts will be employed. During the night of Oct. 31 local celebrations in expectation of promoting the enterprise will be held along the route of the proposed highway.

The climatic conditions in southern California are especially favorable to the use of motor vehicles, and there is probably a greater number of both pleasure cars and service wagons in use there than in any other section of the country. From Los Angeles in every direction are good roads to the suburban towns, and between points and the city the greater part of the haulage is by motor wagons. There is not a section that is not served by at least one, and some by several different transportation lines.

THE ELECTRIC MOTOR CAR CLUB OF BOSTON.

By O. G. Draper.

AS A user and enthusiastic sponsor of the electric passenger and commercial vehicle, Boston now compares favorably with her friendly rivals, New York and Chicago. To be sure, there are not as many trucks in Boston as in New York, nor as many passenger cars as in Chicago, but when one looks back upon the old days and then casts his eyes upon the traffic thoroughfares and the park system of the Massachusetts city, he cannot help becoming confident that the electric has "arrived" in the Hub.

Day Baker, Treasurer of the Electric Vehicle Association of America.

Some years ago, in the infancy of the electric vehicle, Boston financiers, over zealous in their advocacy of the electric, were considerably out of pocket in supporting an electric cab company. Its failure, according to those familiar with the subject, was due to expecting too much from the electric vehicle in what might be called its embryonic state.

The prejudice instilled by this beginning has been dissipated by the marked increase in efficiency of the electric and by two powerful agencies, the aggressive, whole-hearted campaign for the electric vehicle of the Boston Edison Company and the splendid co-operation and collective enthusiasm of the members of the Electric Motor Car Club of Boston.

E. S. Mansfield, Vice President, Electric Motor Car Club of Boston.

The club was organized under the auspices of the company and today the central station men are giving liberally of time, thought and funds to the furtherance of the club's work. The company's support has resulted in developing a large number of electric vehicle and accessory branches and agencies in the city, with a rapid increase in sales and prospective sales.

Organized in April, 1911, the early days of the club saw weekly informal meetings, at which temporary chairmen were selected and pertinent subjects discussed. In the autumn of 1912 a formal constitution was adopted and a president, vice president, secretary and treasurer elected. In the spring of the present year a permanent business secretary was employed and definite plans for increased activities made.

J. C. Codman, Treasurer, Electric Motor Car Club of Boston.

Early in its history the club attracted popular attention by a dinner at which were present representatives of the state and city and many prominent business and professional men. This was followed by two annual parades of electric vehicles which were viewed by thousands, occurring as they did on successive Memorial days. A theatre party, attended by many state and city officials, at which were shown motion pictures of electric fire apparatus in action and views of the parades, also served to awaken public interest. President Day Baker has also given freely of his time in the presentation of stereopticon lectures on the electric vehicle before business organizations.

L. L. Edgar, Secretary, Electric Motor Car Club of Boston.

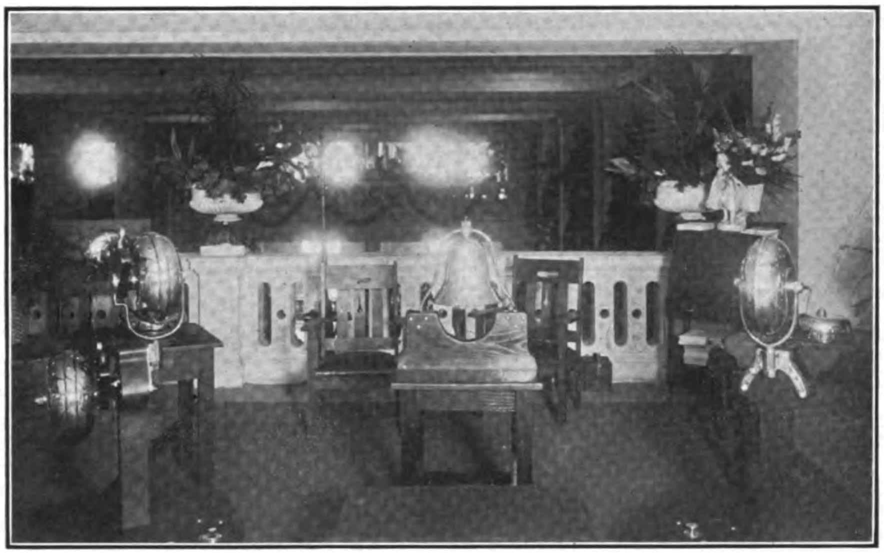
The club co-operated with the New England Section of the Electric Vehicle Association in the sales and advertising convention held last May. Many of its meetings and dinners are held on the same evening as the meetings of the section, the club meeting adjourning in time for all present to attend the section's

lecture. Various committees ably assist officers of the club in carrying on its work, among them being those on meetings, finance, legislation, publicity, membership and charging stations.

Meetings of the organization are held once in two weeks during the busy season, the summer activities consisting of the annual outing and occasional meetings, the executive committee carrying on the work of the organization.

The legislative committee took an active part in the campaign against the motor truck tax bill, which was finally defeated in the House after being twice reported by the committee on roads and bridges and passed by the Senate.

Co-operative and individual advertising has been done under the auspices of the publicity committee, while, co-operating with the charging stations committee, a booklet descriptive of many tours for electric vehicles and containing a complete list of charging stations in the six New England States, was published. At the present time members of the club are co-operating in the publishing of electric vehicle pages in the Boston newspapers.



The Display of Signal Bells Shown at the New York Fire Apparatus Exhibition by the New Departure Manufacturing Company.

The membership of the club when first formed was about 40. This has increased in the two years more than 200 per cent. With the opening of the present season many additional features will be added which will materially increase the club's membership.

The officers of the club during the past year were: President, Day Baker; vice president, E. S. Mansfield; secretary, H. F. Thomson, and treasurer, J. S. Codman. No greater appreciation of their self-sacrificing work in the interests of the organization can be shown than the action of the nominating committee in unanimously reporting them for re-election, with the substitution of L. L. Edgar for Mr. Thomson, who refused renomination because of pressure of other duties.

The club's office is located at 39 Boylston street, where Business Secretary O. G. Draper is present to aid, in all possible ways, both the membership and all others interested in the electric vehicle. Here the resources of the organization are at the disposal of any visitor and any definite information required may be obtained.

CROSS-COUNTRY WITH AN ELECTRIC.

From Boston to Burlington, Vt., at Average Speed of 19 Miles an Hour.

Col. E. W. M. Bailey, general manager for S. R. Bailey & Co., Amesbury, maker of the Bailey vehicles, drove a Bailey runabout, such as is adapted for service purposes, from Boston to Burlington, Vt., and return, the occasion of his visit being the annual meeting of the New England Section of the National Electric Light Convention, Sept. 17-19. The machine was equipped with an Edison battery. The route was through a country through which an electric had never before been driven, and the driver had never been over the road save to Concord, Mass., but had visited Fitchburg, Mass., and Burlington.

The route was through Fitchburg, Ashby, Jaffray, Dublin, Marlborough, Keene and Walpole, N. H., and Bellows Falls and to Springfield, Vt., where the night stop was made, and the following day through Brandon, Middlebury, New Haven and Vergennes to Burlington, a total distance of 258 miles, including numerous detours of from two to six miles because of road repairs.

The average speed for the run was 19 miles an hour, the total running time being 13 hours and 35 minutes. The slowest run was the 42 miles from Keene to Springfield, at 16.7 miles an hour, made almost entirely after dark. The fastest driving was from Boston to Fitchburg, at an average of 21.3 miles an hour. The 78 miles from Rutland to Burlington, including detours, was made at 20 miles an hour. The battery was 60 A-5 cells, and the car had been driven 10,700 miles in 11 months. The machine was given a normal charge at Boston and was "boosted" at Fitchburg, Keene, Springfield, Rutland and Middlebury—the rates varying from 30 to 150 amperes. The normal charging rate is 37.5 amperes. No attempt was made to run an extreme distance on one charge.

The White Company has delivered to Boggs & Buhl of Pittsburg, Penn., two 20-passenger omnibuses, and this firm has established a free transportation service between its store on the North Side and the "down town" portion of the city and the railroad stations. The machines are electrically lighted and started, and are heated. They are upholstered in leather and are in every way attractive.

ELECTRIC VEHICLE ASSOCIATION CONVENTION.

AT THE Hotel La Salle, Chicago, Ill., Monday and Tuesday, Oct. 27 and 28, will take place the fourth annual convention of the Electric Vehicle Association of America, which will be the first meeting of the organization ever held west of New York City. The membership of the association is now approximately 450, representing more than $500,000,000 capital, and it includes, besides the manufacturers of electric pleasure cars and service wagons and their sales forces, the manufacturers of electric vehicle accessories and equipment, battery makers, tire makers and central stations and the owners and managers of public garages.

The purpose of the association is to promote the use of electric vehicles for pleasure and service purposes, and it is broad-gauged in that its endeavors are without reference to any type, class or make of vehicle. The activities of the association are necessarily most productive where the membership is largest, and where organization has permitted systematic and continuous promotive efforts, but in many localities the activity of a single member has brought about a material degree of interest.

The association has three divisional organizations, known as sections, one in New York City, second covering New England and the third in Chicago. These have regular meetings in New York City, Boston and Chicago, but outside of these cities and their suburbs there are not as yet more than casual gatherings. The purpose is to organize these divisions or sections in different parts of the country as rapidly as this can be done effectually, and to systematically educate the people to the qualities, economies and practical possibilities of the electric vehicle.

One of the purposes of the association is to provide for representation for the sections among the officers and directors of the association, and this will be done by the presentation of the following proposed amendment to the constitution of the association. Now the officers include a president, vice president, secretary, treasurer and 12 directors. The amendment as proposed is: "That section 1 of article 5 of the constitution be amended to read: 'The officers of the association shall be a president, three vice presidents and a secretary and treasurer. The offices of secretary and treasurer may be filled by one person. The officers shall be elected from the members in good standing at the annual meeting to be held on the second Tuesday of October in each year. Election shall be by ballot.'"

The delegations from New England and the East will leave New York the afternoon or evening of Oct. 25. The New England delegation will probably start from Boston in a special car in charge of Master of Transportation O. G. Draper, and will be joined at convenient points between Boston and New York by delegates. At New York the New England delegates will join the New York and Philadelphia delegates and a special train will start from that city in charge of Master of Transportation F. Nelson Carle. It is expected that the delegation will be joined en route by others and the entire party from east of Chicago will reach Chicago Sunday evening. At Chicago the headquarters will be at the Hotel La Salle.

The convention will take place at the hotel and there will be morning and afternoon sessions both days. If the expectations are realized there will be upwards of 300 delegates in attendance at the opening, and it is probable that, with invitation extended to the interested public to listen to the proceedings, there will be a large number of visitors. Monday morning the delegates will register at the registration bureau in the lobby of the 19th floor of the Hotel La Salle. The morning session will be called to order at 10 o'clock by President Arthur Williams of New York in the Red Room at the north end of the 19th floor, and following his address will come the report of Secretary Harvey Robinson, the report of Treasurer Day Baker and the reports of the committees on papers, insurance, standardization, garaging, publicity, membership and operating records, will be followed by that of the committee on rates and charging stations. The last will be presented by Chairman John F. Gilchrist. The nominating committee will be appointed at this session.

The first part of the afternoon session, which will begin at 2 o'clock, will be devoted to reports, which will be made for the New York Electric Vehicle Association by Secretary Harvey Robinson, for the New England Section by J. A. Hunnewell of Lowell Mass., the new president; for the Electric Motor Car Club of Boston by President Day Baker, and for the Chicago Section by Chairman Homer E. Niesz. The papers for the afternoon will be as follows: "Traffic Problems and the Automobile", by Dr. E. E. Pratt, manager of the Industrial Bureau of the Merchants' Association of New York City; "The Merchant, the Central Station and the Electric Truck", by F. Nelson Carle, advertising manager of the General Vehicle Company, Long Island City, N. Y., and "Co-Operation Between the Electric Vehicle Manufacturer and the Central Station", by A. L. Callahan, representing the National Electric Light Association. At 6 o'clock there will be a beef steak dinner, served the delegates and guests in the Grand Ball Room at the south end of the 19th floor of the hotel.

Monday evening the delegates will leave the hotel about 8 o'clock in automobiles and will make a sightseeing journey to different electric garages on the South Side, stopping at those best equipped (one of which is referred to as the finest electric passenger car garage in the world), and at several department store garages, and will return to the hotel about 10:30 for a cabaret show and smoker. There will be no charge made the delegates or their friends for the beef steak

dinner, or the cabaret show that will follow it.

The morning session of the second day the nominating committee will make its report and then will come papers on "Charging of Storage Batteries in Unattended Garages", by Maxwell Berry; "Electric Vehicle Salesmanship", by George H. Kelly and E. J. Bartlett; "The Electric Vehicle in Department Store Service", by C. A. Duerr and David B. Tobias, and "Recent Developments in the Lead Battery for Electric Vehicles", by Bruce Ford of the Electric Storage Battery Company, Philadelphia. The election of officers will conclude the morning session.

At 12:30 the Commonwealth Edison Company of Chicago will give a luncheon to all the delegates and their friends in the main dining room of the hotel, and tickets of admission can be obtained from the secretary or at the registration bureau at request.

The final session of the convention will be begun at 2 o'clock in the grand ball room, and it will be devoted to the reading of papers on "Electric Commercial Vehicle Tires" by F. E. Whitney of the Commercial Truck Company of America, the report of the publicity and advertising committee by Vice President Frank W. Smith, and a talk by Ralph Temple of the Ralph Temple Garage Company on "How to Make the Business Healthy."

The offices of the association officers and the various committees and the rooms for exhibition purposes will be on the 18th floor of the Hotel La Salle, and the convention will meet on the 19th floor. The exhibition rooms will be used by those who desire to make displays during the period the convention is in session.

STORAGE BATTERY DEVELOPMENT.

THE Philadelphia thin plate cell, made by the Philadelphia Storage Battery Company, is a development that affords an increase of battery capacity of no less than 45 per cent. This cell has been developed with reference to every other quality as well, and today it is a standard of the industry and is recognized as a product that is in every way dependable and efficient. The Philadelphia cell is a lead type and it is produced with plates varying in thickness proportionate to the duty required of the battery. Four types are made, the thickest of which is designated as W, the next WM, the third WT and the fourth or thinnest WTX, and of these the WT and WTX types are usually provided for vehicle use, where the greatest capacity is required. A cell of any given size will not vary greatly with a variance in plates, although there is a slight reduction in weight as the thinner plates are used, this being due to the use of a greater number of plates as they are decreased in thickness. But the increased surface area exposed to the electrolyte correspondingly increases the amperage capacity, and this is the actual energy that is either charged or discharged.

The Philadelphia cell is built with the purpose of securing a very large measure of endurance, and it is maintained that with normal use the positive and negative plates will have a nearer approach to uniformity of life than is usual with lead cells, this being particularly true of the WTX plates, a result that is largely obtained through proportioning, and the jars in which the element is enclosed are sufficiently deep below the plates so that there is little if any probability, of disintegrated active material accumulating in sufficient volume to become dangerous. In other words, the necessity of flushing or cleaning the sediment from the cell to safeguard against or to prevent short-circuiting, is believed to be remote.

The Philadelphia thin plate is believed to be almost immune against buckling or serious distortion from the effect of charging and discharging, provided that the battery is used as recommended by the manufacturer, this from the fact that the grid or frame is so constructed that the "diamonds" have practically the same effect as the "truss" and the alternating intersections of the diagonal members of the plate effectually lock the active material and prevent its dislodgment during the periods of activity. The "diamond" form of the diagonals and the longitudinals, of which there are five, prevents elongation and warping, and while exhaustive tests have been made with a view of ascertaining the effects of extreme stresses, the construction has endured to such an extent that the strongest claims are made for the cells. The thin plate cells recommended by the company are designed for both pleasure and service vehicle work, where it is essential that high voltages be maintained, and where the demands are at times very heavy.

The Philadelphia cells are made with different sized plates, and with different sized elements, ranging from seven to 21 plates of the W type, from nine to 25 of the WM type, from nine to 29 of the WT type, and from nine to 33 of the WTX type, these being adapted either for pleasure car or service wagon use, and from five to 11 of the C type, seven to 13 of the CM type, seven to 15 of the CT type, and from seven to 15 of the R type, the last four types being intended only for pleasure car batteries.

There are characteristics in the manufacture of the cells and the parts from which they are assembled that are peculiar to Philadelphia cells, and it is claimed that in every respect the material, workmanship and finish are high grade and can be depended upon as being to an extremely high standard of manufacturing. The company also produces batteries for ignition and lighting purposes, which are of equal quality and dependability, and have been as carefully developed for the uses required of them as have been the cells designed for vehicle use. These are made in different sizes and with standardized construction, and are designed for long endurance under extreme conditions. These batteries are supplied either with or without special cases.

THE NEW G. V. MERCEDES SIX-TON TRUCK.

THE General Vehicle Company, Long Island City, N. Y., is now prepared to produce commercially the General Vehicle Mercedes truck, which it will build in one size only. Early in 1912 the company acquired the American rights to manufacture under a license the Mercedes truck or trucks, and it has since that time imported several machines to meet the demands of several customers. With the completion of the new buildings of the plant, work on which has been in progress for about a year, a distinct gasoline truck division will be created, which will have separate buildings and facilities for the production of Mercedes machines.

The purpose of the company is to turn out a high grade truck from every point of view. The Mercedes design was regarded as being thoroughly tested by 13 years' experience in actual service in Europe, and was acquired because of the dependability of the machines in service, and the material and workmanship will be the best that can be obtained. As to factory equipment, there will be no better than that provided for the Mercedes department.

The truck will be practically in duplicate of the machines built in the German factory. It will have maximum speed of 10 miles an hour. The chassis will be standard outside of the motor, for two sizes of engines will be built and either installed to meet the requirement of the purchaser. For conditions where the need of power is extreme a motor rated at 45 horsepower will be provided by the maker, but for work where there is not as great a demand a 35 horsepower motor will be recommended, but either size will be optional with the purchaser.

Though built for heavy work the weight of the machine will be minimized by the use of the best of material and very careful proportioning, and the design is expected to insure unusual endurance and strength. The truck is conventional throughout and the drive will be through a jackshaft carried in combination with the rear axle and by pinions on the jackshaft meshing with internal gears mounted on the rear wheels. Especially noteworthy is the coupling of the driving shaft and the radius rods at a heavy middle cross member of the frame, the driving thrust being practically in a straight line from the rear axle to the frame member, without stress upon the power transmission system. The vertical movement of the rear axle is not restricted and the springs are relieved of all driving thrust. Under normal working conditions there is very little, if any, inclination of the driving shaft.

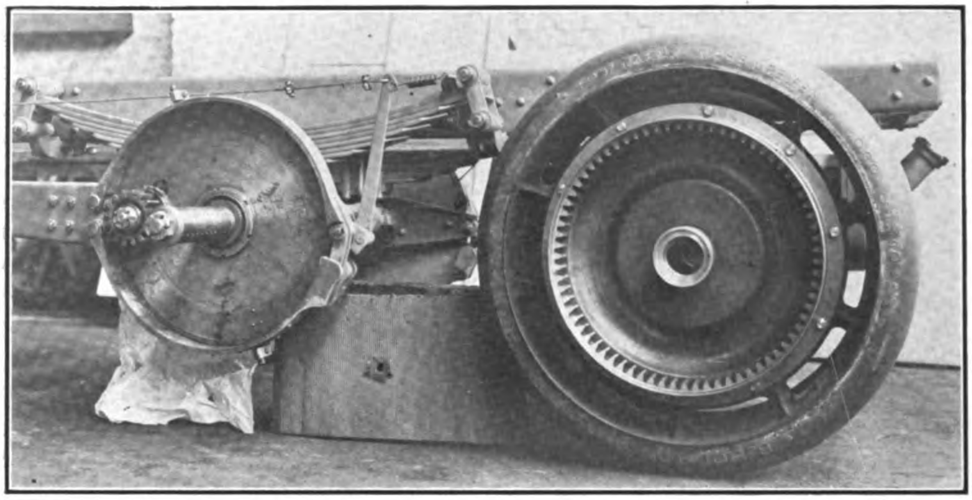
The actual weight of the chassis, with the gasoline and oil tanks and the cooling system filled, is 6380 pounds, and with a maximum allowance of 2000 pounds for a body, which is regarded as ample for any form of equipment, the weight of the complete truck is placed at 8500 pounds. When the truck is light the forward wheels carry 3400 pounds and the rear wheels 5100 pounds, but with a load of 12,000 pounds the forward wheels support 4500 pounds and the rear wheels 16,000 pounds, this placing 91.66 per cent. of the useful load over the rear axle and 8.33 per cent. over the front axle.

The Six-Ton G-V Mercedes Gasoline Truck and a Trailer, Both Loaded, Showing the Capacity of the Machine for Haulage.

The motor rated at 35 brake horsepower at 850 revolutions has a cylinder bore of 4.25 inches and stroke of 5.9 inches, and the motor rated at 45 brake horsepower at 800 revolutions has a cylinder bore of 4.74 inches and stroke of 6.29 inches. The engines are identical save in part dimensions. They are a four-cylinder, four-stroke cycle, water-cooled, I head type with the cylinders cast in pairs. The valves are mounted in the heads of the cylinder units and are actuated by pushrods. Extreme efficiency is claimed for this motor. The speed of the motor is governed by a governor enclosed within the crankcase, and it cannot be tampered with by the driver.

The engine has plain bearings throughout, there being unusual length to the crankshaft journals. The water circulation in the cooling system is actuated by a centrifugal pump. The provision of lubrication is adequate, this being a combination of the force feed

and splash, with centrifugal distribution over the interior of the engine case. The ignition is by a high-tension magneto. The clutch is a cone of large size with wide bearing surface and this is actuated by the customary pedal. The transmission gearset is a selective sliding gear type, affording four forward speed ratios and reverse. These ratios give 1.08 miles, 4.09 miles, 6.98 miles and 10.82 miles an hour. The complete reduction of the driving system is 14:1, of which 4.5:1 is between the pinions at the ends of the jackshaft and the internal gears on the rear wheels.


The Internal Gear and the Driving Pinion and the Axle Spindle of the G-V Mercedes Six-Ton Gasoline Motor Truck.

The chassis frame is a pressed steel channel section of liberal dimensions, and this is 21 feet five inches length. It is mounted on semi-elliptic springs of comparatively slight arc. The front and rear axles are heavy steel forgings. The wheels are of steel, the forward set being shod with 34 by five-inch single band tires, and the rear set is equipped with 40 by six-inch dual band tires. The wheelbase is 169.25 inches and the tread 60.625 inches. The driver's seat is at the right and the speed changing and the emergency brake levers are at the right of the driver. The machine has two sets of brakes, one on the main driving shaft and the other on the rear wheels, the former actuated by a pedal and the latter by hand lever.

The chassis as delivered is fitted with a driver's seat, step, front mudguards, gasoline tank, dash and tail lamps, horn and the usual hand tools.

B. A. GRAMM'S ONE-TON WAGON.

The Gramm-Bernstein Company, Lima, O., has begun the production of a one-ton wagon that in design differs somewhat from the larger machines that this firm has produced, and which in every respect conforms to general practise. The methods of building and the materials used have been determined with extreme care and the vehicles are intended to have unusual life and endurance. The motive power is a four-cylinder, water-cooled Continental motor, having cylinder bore of 3.75 inches and stroke of 5.25 inches, and is mounted on three points. The clutch is a cone and the gearset is a type affording three forward speeds and reverse. The drive is by shaft and jackshaft and side chains. The axles are of unusual size. The two sets of brakes operate on and in the drums on the rear wheels. The springs are long and those at the rear are underslung. The drive is left side and the control levers are at the centre.

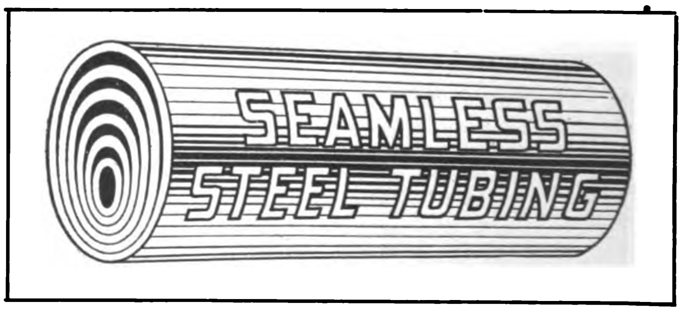
In designing the vehicle care was taken to have all the mechanism very accessible. The motor is carried forward of the dash and under a hood and this is fitted with a standard float feed carburetor and a Bosch magneto. The wheelbase of the wagon is 130 inches and as the frame behind the seat is 102 inches length a 114-inch length body may be installed. The tires are 34 by three-inch forward and 34 by 3.5-inch rear, those of the solid type being used. The gasoline is supplied by gravity from a tank carried beneath the seat.

SEAMLESS STEEL TUBING.

Edgar T. Ward's Sons Manufacturing Wide Variety of Shapes, Also Brass and Copper Tubing.

Edgar T. Ward's Sons, 25 Purchase street, Boston, Mass., maker of round, oval, rectangular and other shapes of mechanical, high carbon seamless steel tubing, is prepared to supply the trade at short notice with cold drawn steel tubing especially adapted for making bushings, jigs, etc., and motor car work. The tubing is constructed to standard gauge, with varying outside diameters and wall thicknesses. The material can be tempered.

The company also produces hot drawn steel tubing with walls of different thicknesses. A specialty is made of brass and copper tubing for gas and oil, it being made in 20, 21 and 22 B. & S. gauge and of different sizes to meet requirements. The company issues a booklet giving complete dimensions, details, etc., which will be mailed free upon application, and is prepared to make any size not listed.



THE NEW ENGLAND SECTION, E. V. A. OF A.

By O. G. Draper.

ENTERING upon its fourth year, the New England Section of the Electric Vehicle Association of America looks forward to a brilliant future for the electric automobile in the six states. This optimism is based upon the rapid growth in popularity in the past three years and upon the type of men who are giving liberally of their time and energy to the furtherance of the organization.

The object of the section may be stated to be the focussing upon its territory of the work of the national organization and the institution of activities of peculiarly local interest and application. In connection with the Electric Motor Car Club of Boston the section is making the electric vehicle an important factor in the transportation world of New England. As an illustration of this there were in New England at the time of the section's inception, approximately 600 passenger and 275 commercial electrics. On Oct. 1, 1913, there were 984 passenger and 574 commercial cars.

The section has contributed to this noteworthy increase in many ways. Through its meetings it has developed the ability of its members to sell cars, it has served to cement all interests in a common cause and has driven home forcibly the superiority of the electric vehicle in its field. Its committees have made possible the making of long tours through the establishment of many charging stations, and have protected the interests of electric vehicle owners from unjust legislation and excessive fees.

A word as to its history. The section was organized April 17, 1911, with the following officers: President, E. S. Mansfield, Edison Electric Illuminating Company of Boston; treasurer, John A. White, National Battery Company; secretary, William F. Kimball, Charles N. Tenney & Co. Mr. Kimball resigned in September, owing to pressure of business, and was succeeded by Wellesley Holmes of the Cambridge Electric Light Company. Its membership in October of that year was about 35.

The following year its activities were broadened. A feature of the year was a trip by electric automobile to the Lynn plant of the General Electric Company, where the members had opportunity to study vehicle apparatus in the making. Among special subjects discussed at meetings were the plans for a belt line electric freight railway in Boston, costs of operation of electric trucks, the 1912 Boston electric show, tires and vehicle meters. Officers were the same as during the previous year, the membership being about 60.

During the past year the section's work was broadened. A permanent business secretary was engaged in co-operation with the Electric Motor Car Club. A two-day sales and advertising convention was conducted with papers on many subjects by leaders in the movement from all sections of the country. Ten states were represented on the floor of the convention. Advertising matter for distribution by central stations among their customers has been prepared.

The officers for the year were: Chairman, Fred M. Kimball of the General Electric Company; vice chairman, Edward S. Mansfield of the Edison Electric Illuminating Company of Boston, and secretary-treasurer, Leavitt L. Edgar of the same company.

During the coming year the following activities will be added to the work of the section:

Under direction of an educational committee courses in electric vehicle practise will be arranged for, both independently and in connection with institutions of learning. Meetings will be held in various cities, the next takng place in Providence, R. I. The legislative committee will watch legislation in all New England states. An attendance and discussions committee will make the meetings more enthusiastic.

Under the leadership of J. A. Hunnewell of the Lowell Electric Light Corporation as chairman, and Messrs. Mansfield and Edgar in their same offices, the fourth year of the section will be its most fruitful, the result of steady growth of an organization of definite aims, aggressive membership and capable direction.

In closing, the attention of electric vehicle owners is directed to the manifest advantages of membership in the section. The educational features, the work of the legislative committee, the information bureau, the development of sanctioned garages and charging stations and the social side of the work will prove a valuable investment for any owner.

Headquarters of the section are established at 39 Boylston street, Boston.

With the installation of new machinery the Spicer Manufacturing Company, Plainfield, N. J., has changed its working schedule from five days and nights weekly to six days a week, with overtime work but a portion of the night. The improved facilities will permit the manufacture of new products later on.

The Weston-Mott Company, Flint, Mich., has added a fireproof building 350 by 75 feet, which will be known as No. 7, to its plant, in which will be located the galvanizing, forging and heat treating departments. In this building the work will be handled progressively and with decided economy.

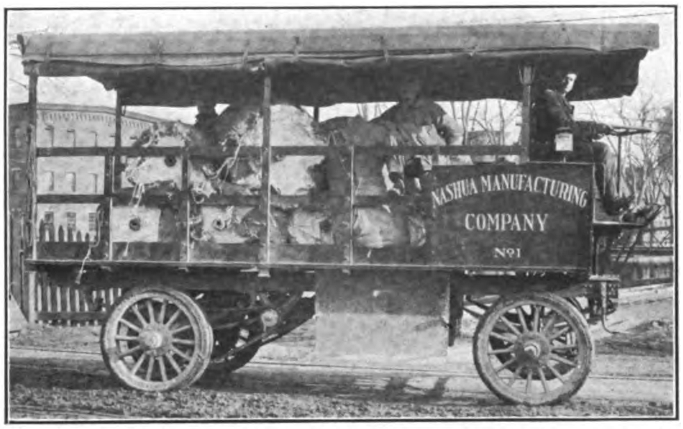
The Lord Baltimore Motor Truck Company is planning to erect a two-story factory building 600 by 125 feet at Canton, O., and will later remove its plant there from Baltimore.

C. C. Bradford, who was manager of the Cleveland, O., branch of the United States Light & Heating Company, has been made sales manager of the company and is now located at 30 Church street, New York City.

MOTOR WAGONS IN TEXTILE MILL SERVICE.

The Advantage of Improved Means for Inter-Factory and Yard Haulage—A Paper by Day Baker, Read to the National Association of Cotton Manufacturers.

"ADVANTAGES of Commercial Motor Cars in Cotton Manufacture", was the title of a paper read by Day Baker, district manager of the General



One of the Two Electric Wagons Utilized by the Nashua Manufacturing Company at Nashua, N. H.

Vehicle Company for New England, at the semi-annual meeting of the National Association of Cotton Manufacturers held at Atlantic City, N. J., Sept. 30-Oct. 2. This association is composed of large manufacturers from all parts of the country, its membership representing the cotton manufacturing industry, which is one of the largest of the nation and in which a vast amount of capital is invested.

Enterprises of this character must of necessity have extremely comprehensive accounting, and it is a general custom to compute to a thousandth of a cent in the house bookkeeping, so that it is practical to assume that costs are probably better realized and are more accurate than with the systems of other industries. This being so, the accounting will permit closer comparison, and these comparisons will determine economies more clearly and precisely than are known by others that have less definite data.

The success of manufacturing is dependent largely upon economies, and whether these be realized in production, in transportation, in handling, or in any work or process, the method that will effect a saving is regarded as justified. The attention given to highway haulage and to inter-department transporting by these concerns is no more than to other manufacturing detail, although until a comparatively short time ago the means of economizing now available had not developed to such practicality that their value was recognized.

Because of the interest in mill yard, inter-factory and general transportation, Mr. Baker, who addressed the first meeting of the year in 1909, was again requested by the association to address the members. The paper was prepared in pamphlet form, which was illustrated by a series of examples of actual use of both highway and factory vehicles, and by a large number of lantern slide views from photographs made in different sections of the country. The paper was devoted to electric wagons, trucks and industrial trucks that may be utilized in mills, shops, railroad and shipping terminals, mill yards and wherever heavy or bulky material or packages are handled. Naturally, the work illustrated was of every character and in widely varying conditions.

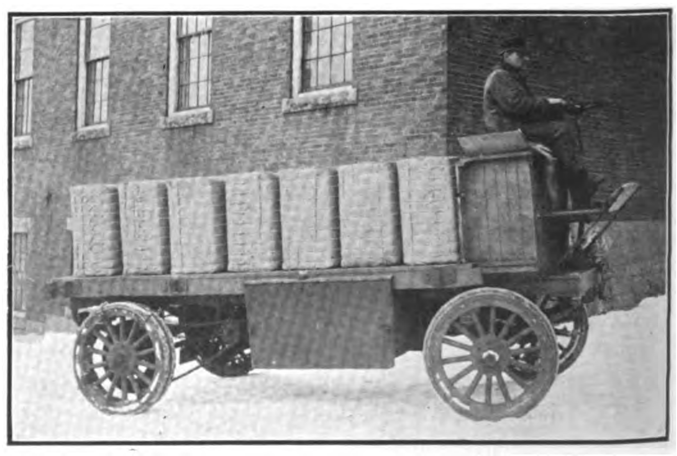
Mr. Baker's paper, so far as it related to highway vehicles, was as follows:

The arguments which I presented before this body four years ago should appeal today stronger than ever to those who in the meantime have not adopted the electric truck, and profited thereby. The four years' experience of those who possessed electric trucks, and the experience of those who have purchased such equipment since, has amply proved the truth of the arguments on economy and efficiency which were then advanced.

The problem, which I am happy to say many mill and factory men have solved, still confronts many agents, superintendents and yard masters; the problem of the proper, expeditious and economical handling of the raw material as it arrives, as it passes through the various processes until it becomes "finished goods", and then is delivered to the storehouse or to the freight house, where the responsibility of distant delivery is turned over to the railroad or steamship line.

Not only are the problems of transportation encountered in handling the actual raw material, material in process, and the finished goods, but in the many contingent parts of mill work there also arise numerous calls for transportation of some character, which work can usually be much better done by motor vehicles than by any other method. As an example, it was recently arranged that an electric winch be applied to one of the yard trucks of a Lowell textile plant. With this electric winch freight cars will be pulled out of a freight shed where locomotives and gasoline driven vehicles are prohibited. This winch will also be used for loading heavy cases. The truck will as well be used for shifting freight cars around the loading platform. These are only a few of the many diversified uses to which an electric truck may be applied.

The bales of cotton or bags of wool and other raw material or general supplies, if not delivered by the railroad direct into the storehouse, must be carted there. Perhaps it is then necessary to team it to the picker room, to start it on its long journey through the course of manufacture. After being spun into yarn it may be necessary to transfer it to a somewhat distant mill. The goods being woven may have to be carted to the bleachery, the dye house or the finishing departments, and from



Two-Ton General Vehicle Wagon Used by the Pepperell Manufacturing Company at Biddeford, Me.

these to other departments or to the storehouse, and perhaps later to the freight house.

Not every mill is so fortunate as to have its coal delivered from the railroad cars or boats direct to its coal sheds or boiler

rooms, and therefore many mills are confronted with the additional problem of the transfer of coal from railroad lines and wharves to their own storage, and from there to their boiler rooms, many mills making two, and some, three transfers.

One-Ton General Vehicle Wagon with Special Body Equipment in the Service of the Pepperell Manufacturing Company.

After the process of combustion, the remnant of the coal (the ashes) must be carted to such places as are being filled, or to the dump. Three of New England's large textile mills are making a profitable business of selling their ashes for sidewalk construction and filling purposes, making deliveries by motor trucks.

The material for shipping boxes does not come in on wings; it requires hauling to the carpenter shop and from there as boxes to the finishing room or shipping department. The barrels of dye and bleaching materials will not roll themselves to the storehouse, and from there to the dye works or bleachery; they must be teamed, and their weight is such that they make heavy loads. Lumber must be moved to the various places around the mill yard where repairs are going on, or if construction work is in progress, bricks, lime, cement, crushed stone and gravel must be carted.

These are some of the many problems that confront the superintendent of the mill or factory.

The Horse Drawn Period.

Years ago almost the only means employed in transportation in the mill yard was the slow plodding oxen, and even now you will occasionally find a few yoke of them slowly drawing their cumbersome trucks loaded with material or finished goods.

Later, as the world progressed and speed became one of the requirements, the more flexible and faster moving animal, the horse, was introduced for service around the mills. The horse, man's faithful friend, has done great work, but his day is fast going. The increase during the past few years in the price of horses, together with the rise in cost of all kinds of feed, is fast putting the horse in the list of luxuries. In addition to the high cost of the horse and his keeping, we are, with the keen competition of the 20th century, calling for an increased amount of work in a given time, less manual labor, a speedier transfer of goods and improved hygienic conditions around our manufacturing communities.

According to one of our best writers on health subjects for the masses, 40 per cent. of the disease and deaths accounted for by our hospitals may be directly traced to the horse, which aided by the wind, the fly and the rat, scatters broadcast death-dealing germs.—"The Horse vs. Health" by Harold Bolce.

It has also been shown by highest authorities that delays in work caused by sickness or death among employees are not only a distinct economic loss to a town, city or state, but also affect the cost of manufacture. Therefore, for the reasons given above, and for the additional good reason that a better and cheaper method has been found, the day of the horse around mills and factories is on the wane.

Twentieth Century Methods.

We no longer weave by hand, nor do we travel by the stage coach, and as the world moves, so the conditions around the factories and mills change. Therefore, we should no longer cling to the use of brute force for the transfer of heavy weights. The lightning subdued by the brain of man, and harnessed by the generator and motor, now stands ready to do our bidding, better, quicker, cheaper and without the unhygienic conditions which surround the stable and the horse.

In order to avoid the fire risk entailed with steam locomotives, various experiments have been made in yard transportation, with compressed air. One of the experiments met with considerable success at the Plymouth Cordage Works, where small locomotives supplied with compressed air drew and shifted industrial cars. But this method was finally abandoned.

In some instances tracks and industrial cars, drawn by small steam locomotives, have been installed in the endeavor to better yard transportation, but the work of almost any mill is of such a varied character that the network of tracks required to reasonably cover the routes desired, the cost of laying them, and keeping in repair, more than offset their apparent saving. And then again, it is often desirable to use the mill yard vehicles around the town or city, outside of the mill property on the public highways. This cannot be done if industrial rail cars are used. Therefore, trackless transportation in and around mills is really what is required.

A Trackless Vehicle Desired.

As vehicles operating around a trackless mill yard and town or city roads must be supplied with power, the nature of the motor is first to be considered. At once gasoline must be discarded except for long runs outside of mill or factory yards, not only on account of the expense of operation and maintenance, but on account of the serious fire risk involved. Electricity seems to be the most natural power to be considered, not only on account of its cheapness, but because of its cleanliness, safety and flexibility. Therefore, the logical method of transportation for the mill and factory yard is trackless, electrically driven vehicles. As the conditions are trackless, the vehicle used must be self-contained, which means that its power, derived from the generator, must be accumulated in storage batteries; therefore, we have given as the desirable method of transportation an electrically driven, storage battery truck.

In considering any method of transportation there are three things to examine: the road, the load and the vehicle. In trackless transportation the road must be accepted as it exists. In mill work the load must be accepted as it is received, and it must be delivered as ordered. These two factors of transportation are the same, no matter what method is employed. Hills, bad roads, frequent stops and starts, long routes or heavy loads are equal in the demand made on animals or machines of any kind. The third factor, the vehicle, is the only one with which the solution of transportation problems can be made any easier.

Just as the electric street car has solved the problem for passenger transportation in cities, so has the electrically driven truck opened the way to a simple freight and delivery system around mill and factory yards, and towns and cities.

The Electric Vehicle.

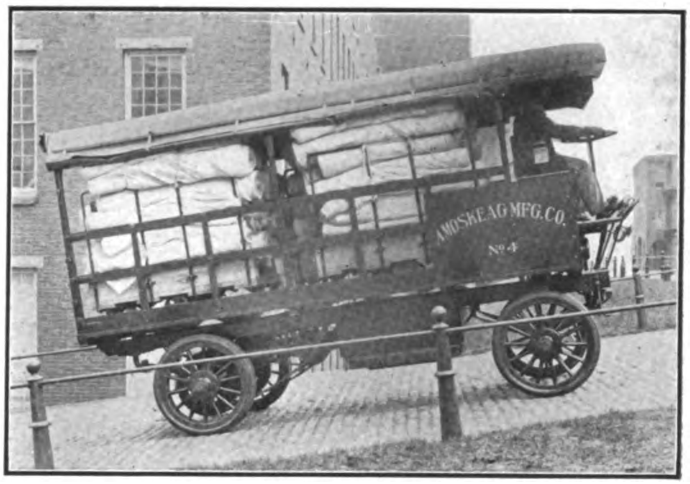
The electric vehicle for trucking and delivery is purely a mechanical proposition. It is a machine. Like other machines it can be built to do a given amount of work in a definite time at a certain cost under any known conditions.

The safely carried load in pounds or tons is the basis of its mechanical design and construction. The specified speed with full load on hard level determines how much power will be required. The specified duration of continuous operation at full load on a hard level determines the amount of energy that must be stored in its battery at one time. This last condition fixes the size of the storage battery. The power and speed required determine the size of the motor and the gear ratios, while the total weight affects the tire design.

The cost of transportation by electric vehicles can be determined just as logically as the cost of operation of any other machine. It is merely a question of measuring the work and measuring the cost and placing one against the other.

Accurate engineering can be applied to the problems of transportation with greater satisfaction with electric vehicles than any other type. Electrical measuring instruments reveal, and record, if necessary, the condition and performance of storage batteries and electric motors. The cost of producing electricity is a known quantity. The amount of electricity necessary to charge a battery is measurable. The amount of electricity delivered to an electric motor by the battery is a known quantity, or can be measured. The performance of an electric motor is accurately specified for any conditions. Its efficiency is easily determined.

The work of moving a ton a mile per hour on a hard level road is expended in starting it from rest and in overcoming the resistance of the road, the tires, the bearings and electrical



One of the Fleet of Electric Wagons Owned by the Amoskeag Manufacturing Company at its Manchester, N. H., Plant.

circuits and the air. If the road is not hard or not level, of course more work will be required to overcome its resistance, or to move the load up a grade. If it is necessary to start often from rest more work must be done than for continuous motion.

To get the cost of operation of its electric vehicles down to the lowest figure the General Vehicle Company has adopted methods that affect the design of the entire vehicle and result in an energy consumption per ton-mile far below any previous figures.

Simplicity has been one of the great factors in obtaining economy and reliability. By referring to the illustration entitled "Power Plant of General Vehicle Electric Truck" you will see that the entire motive machinery of the electric truck is simplicity itself. Four of the simplest forms of mechanism:

A, a series wound motor, practically the same as in use on the thousands of street cars.

B, a Morse silent chain, which in practise is covered from dust and mud by an aluminum case.

C, an enclosed countershaft.

D, standard roller chains.

No gears to change; no clutch; no small parts to wear out or break on the road. No reciprocating parts. The power movement is all rotary. Any mechanic can readily see that with these few moving parts the road efficiency must be high, which, with the low cost of electricity and the low grade of help required to operate, makes a very economical vehicle from the owner's standpoint.

Selection of Electric Vehicles.

The electric vehicle cannot be used profitably where it is not needed. Where the work to be done is less than half the ability of the machine, proper value may not be derived from the investment. Where a large number of vehicles are used the advantages of electricity become more apparent and the efficiency of the service is still more improved.

Transportation by electric vehicles is a subject simple to explain and easy to demonstrate to the satisfaction of anyone interested. The selection of the proper equipment, however, depends on the engineering sense of one familiar with the problem.

Electric Vehicle Economy.

As most manufacturing companies are familiar with the horse drawn proposition, it is of interest to compare that

One of the Three Studebaker Trucks That Have Been Used by the Arlington Mills, Lawrence, Mass., for Several Years.

method with the electric, therefore it may be stated that taking into consideration depreciation, interest, insurance, stable room, shoeing, veterinary charges, harnesses, blankets, stable help and feed, on the horse side of the argument, and the corresponding items against the electric truck, including electric power at four cents per kilowatt-hour, the actual economy in cost shows in favor of the electric truck by 22 to 35 per cent., according to the size and number of vehicles operated and the surrounding conditions.

It should be recollected that the electric vehicle requires only the space it occupies. It needs no hay loft, stalls, harness room, bedding platform or manure pit; nor does it require extra equipment to do twice the work that horses drawing the same capacity per load accomplish. While the stable man is obliged to keep a supply of extra horses to substitute for those which are sick, disabled, or being shod, it is not necessary to have extra motor vehicles on hand, as 98 per cent. of all causes for delay can be provided for in advance and thus prevent or overcome lay-up for repairs.

In a small one-story storage garage, not over 25 by 60 feet, may be housed the complete equipment of five vehicles, which will displace and do the work of nine or 10 horse drawn trucks and 18 to 40 horses, according to the size of truck and the method of working horses. One intelligent mechanic and a helper can easily care for these machines and keep them in first class operating order, while the drivers of the horses in a few days become proficient operators of electric trucks. Notice the economy in stable room and stable help.

While the heat of summer, the chilling rains of the fall, and the low temperature of winter, to say nothing of the glare, icy pavements and deep snow, all work havoc with the health of the horse and make the death rate high; the electric truck knows no seasons, but keeps constantly at its work the year round, good and bad weather alike.

Accustomed as most horses are to moving freight trains and cars, it is, nevertheless, a fact that quite often a good horse will become frightened and run away, causing loss not only to vehicle, harness and load, but frequently irreparably injuring or killing itself or running mate. These incidents all go to make the horse expensive, and form links in the chain of strong arguments for the electric truck.

Arguments Favoring Electric Trucks.

Among the many arguments which should be considered in connection with electric motor vehicle work over horse drawn trucks are: First, the cleanliness in garage and around the yards. The vehicles and the motors driving them, running on very generously proportioned ball and roller bearings, which are sealed, oil and dust tight, require oiling only once in six months, and, therefore, have not the dirt and hot oil throwing proclivities incidental to other forms of motor vehicles. Second, the electric method is much cheaper, requiring a less number of vehicles, therefore less drivers, and the loading and unloading crews are less, or the present force is kept busier. Third, while the current for the charging of the batteries is figured in all commercial estimates on which this argument is based at four cents per kilowatt-hour, it is a fact that most mills or factories can operate a small wheel or a small engine during the night, furnishing power to charge the batteries, or taking current from the lighting plant before the peak of the load, utilizing power which would otherwise go to waste, thus reducing the cost of current to a small fraction of a cent per kilowatt-hour. Fourth, the flexibility in the handling, light or heavy loads carried with equal ease, the turning of vehicle and backing to freight cars, doors or elevators, and its ability, on account of occupying only 60 per cent. of the space used by the horse drawn vehicle, flexible steering, and starting and stopping devices, to travel in congested yards or buildings. Fifth, it can be run into factory buildings, on elevators, into shipping rooms or freight houses, and on docks and wharves, all of which places are barred to the gasoline truck by insurance regulations. Sixth, and most important, the money invested in electric motor vehicle transportation will produce a larger dividend, when compared with present horse costs, than is earned in any other portion of the manufacture of goods.

Just as the electric light has supplanted the candle, kerosene oil and gas, and the electric car displaced the stage coach and horse car, so will the electric truck, one of the most useful inventions of the 20th century, most surely succeed the slow going ox and the expensive horse.

Genius has entered the motor against the quadruped, and all who have witnessed the triumphs of the inventive mind over the clumsier resources of animal strength will realize that the horse must make way for the motor; for science and engineering skill are greater than brute force, and they have produced the electric truck, which is here today as a practical, economical machine.

The Duryea Motor Car Company, Saginaw, Mich., has purchased the delivery wagon department of the Brooks Manufacturing Company in that city and will operate it as a department.

The Chase Motor Truck Company, Syracuse, N. Y., has named N. J. Sherril manager of the districts of North and South Carolina in that concern's selling organization.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC.

Of **The Motor Truck**, Published **Monthly**, at **Pawtucket, Rhode Island**, required by the act of August 24, 1912.

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WILLIAM H. BLACK, Editor.

Sworn to and filed with Postmaster July 11, 1913.

ARTHUR H. CAPWELL.

Notary Public.

My commission expires June 30, 1914.

VAN AUKEN ELECTRIC DELIVERY WAGON.

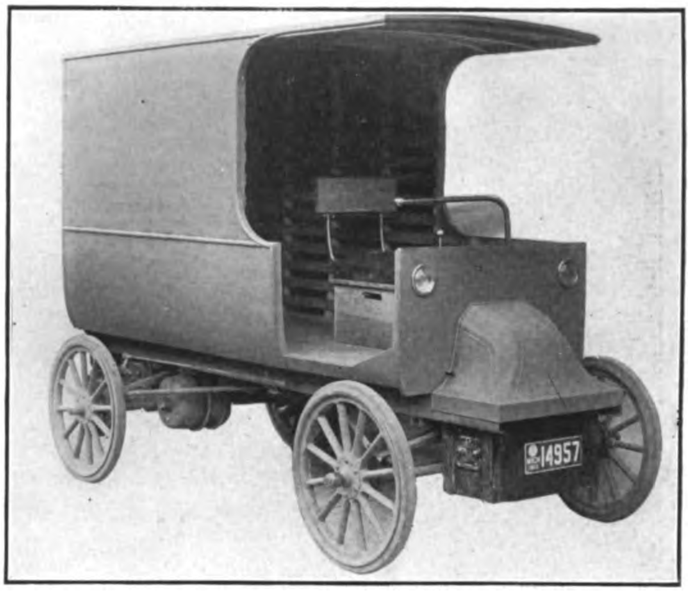
THE Van Auken delivery wagon, built by the Van Auken Electric Car Company, Connersville, Ind., a machine having carrying capacity of 750 pounds, and weighing 1625 pounds without load, has been placed in the market by that concern and will be produced commercially. The vehicle is extremely simple, even for an electric, and it is intended especially for city use, where light delivery made at moderate speed is particularly essential.

In a number of respects Mr. Van Auken has departed from conventional practise and has adopted construction that has been proven satisfactory in other machines. He has reduced weight materially because he uses a comparatively small battery, and he wishes to maintain his mileage as high as possible, and the claim is made that with a battery of but 16 cells from 40 to 50 miles may be driven on a single charge. By exchange of battery, which can be accomplished in less than five minutes, this mileage can be doubled, so that for work that is with a trip within the capacity of the battery unusual economy can be expected.

The wheelbase of the wagon is 80 inches and the tread 51, and the length of the chassis from the dash to the rear end is 90 inches. Back of the driver's seat the loading space is 56 inches. The chassis is not low, the floor being 30 inches above the ground, but the 28-inch wheels cause the machine to appear small. The construction is unusual. The chassis is a steel channel section with strong end and cross members, and this is mounted on two cross springs that are arched above and parallel the axles, the springs being shackled at each end, the swing of the shackles compensating the deflection from the normal form. From the centre of the frame middle cross member radius rods diverge that are connected with the axles at the points where the spring shackles are located, and while these will permit a vertical movement of the axles the relation of the axles is maintained.

Back of this frame middle cross member is another cross member from which the motor is suspended transversely in the chassis, and on the driving end of the armature shaft is a pinion that meshes with a reduction gear mounted on the motor case, and this reduction gear meshes with a gear wheel mounted on the end of the driving shaft. At the other end of the shaft is a second gear that meshes with the crown gear of the differential set. In this shaft at either end are universal joints that compensate for any variance in the height of the motor, and when the body is loaded the shaft is approximately in straight line. A universal joint is at either end of the driving shaft. Practically half the wearing surfaces are included in the driving assembly, there being the two bearings for the armature shaft, two for the motor pinion shaft, three for the reduction gearing, two for the propeller or drive shaft, and four for the differential set, and two in the universal joints, a total of 15. All of these bearings are accessible for lubricating, are protected from water and dust, and should wear for very long periods without attention other than systematic oiling and greasing. The rear axle is a live type with a tubular housing, and the forward axle is tubular. The wheels are 28 inches diameter, and are fitted with two-inch solid tires.

Glancing at the illustration it will be seen that the chassis is remarkably simple. The steering gear is a conventional linkage operated by a tiller, and the brake is a set of shoes expanding in drums on the rear wheel, actuated from a pedal. The battery is divided and is underslung, a crate carrying eight cells being suspended at either end of the chassis frame. It may be removed with ease in very quick time. The arrangement of the terminals is such that no mistake can be made in connecting the battery. The chassis is built



The Van Auken 750-Pound Delivery Wagon with Enclosed Body.

with a short hood ahead of the dash for the machines with covered bodies, but the dash is at the front end of chassis of the open wagons. The resistance is beneath the centre of the body. The controller is a rotary type and is carried beneath the seat of the driver, being operated by a short lever at the left side. The seat is a box that affords storage space and may be lifted conveniently. On the box is placed a well stuffed cushion, retained by straps.

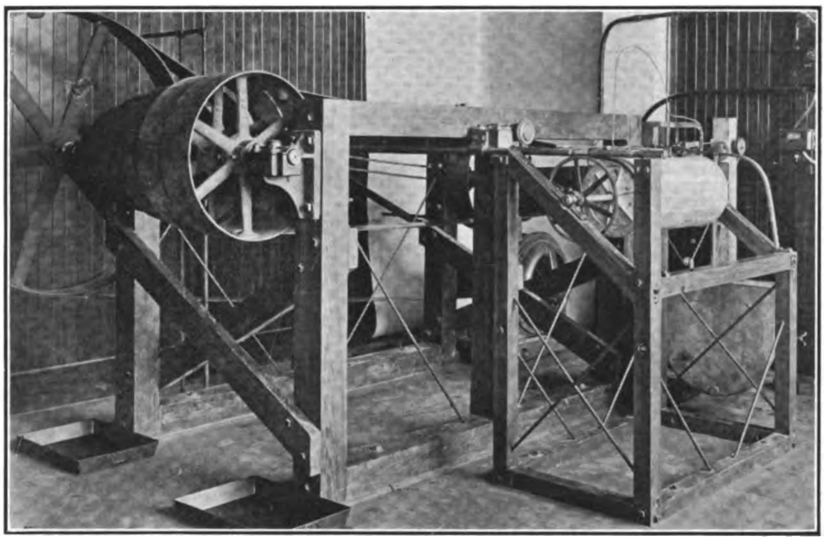
The chassis is fitted with electric dash and tail lamps, a voltmeter, ammeter and odometer. The wiring is large in size and is well protected. Aside from the motor and rear axle assembly there are but 17 places where lubrication is necessary, these being the four spring shackles and spring eyes, the two rear axle bearings, the four front wheel bearings, the two steering spindles, the four connections of the steering gear and the strut rod bearing.

These machines are sold with body equipment complete. The covered type, which is illustrated, has a

regular panel body with entrance at the right side. The left side is completely enclosed. The roof of the top extends forward to the dash, covering the driver's seat. The driver's seat is half the width of the body, so that long packages can be carried conveniently. The length from the dash to the rear is 96 inches, and the space back of the seat is 56 inches length, 41 inches width and the top is 53 inches above the floor. The seat is 21 inches width. The maximum speed is 12 miles an hour and the rated capacity is carrying a load half the distance given as battery mileage.

Charles M. Van Auken, president of the company, was for a considerable length of time engaged in special work for the Ford Motor Company; Guilford C. Babcock is vice president and treasurer; Clarence L. Millard, formerly of the Connorsville Carriage Company is secretary, and O. C. Thompson is chief engineer.

The Wacker & Helderle Undertaking Company has a completely motorized equipment consisting of two hearses, a combination casket and flower wagon and six seven-passenger limousine automobiles, the bodies being mounted on six-cylinder chassis of Premier construction. All of these machines are well equipped and appointed. So far as known this is the only undertaking establishment in the country with only automobile equipment.



Waite Brake Lining Testing Machine Utilized at Factory of Standard Woven Fabric Company, Maker of Multibestos Brake Lining.

The stockholders of the Swinehart Tire & Rubber Company, Akron, O., have increased the capital from $800,000 to $1,000,000 and have elected Fred H. Snyder of Massilon, O., and Charles Curry and T. E. Barry of Akron, directors in the place of Oliver Toomey and T. E. Borton, the last two mentioned declining to continue in the directorate.

The officials of the Mais Motor Truck Company state that there is no truth in the rumor that it was to remove to Columbus, O.

BRAKE TESTING MACHINE.

Standard Woven Fabric Company's Device Eliminates Human Equation.

One of the most interesting machines for testing the efficiency of brakes has been designed and built by E. E. Waite, chief engineer and factory manager of the Standard Woven Fabric Company, Framingham, Mass., maker of the well known Multibestos brake lining. Until recently the most popular method of testing brakes has been to start the car down a steep grade with full power on and the brakes set.

The new machine, which is shown in an accompanying illustration, does away with this primitive method. It has a brake drum of regulation size which revolves within an ordinary brake band. By means of a metal housing, which can be filled with oil or water, any brake conditions existing in any motor car can be reproduced. As this brake drum revolves, there is a certain pull, or tendency for the brake band and brake lining to revolve in the same direction. This is held back by a calibrated pendulum and the amount this pendulum allows the brake band to travel is registered on the chart on a revolving barrel. From this it will be seen that the Waite machine has eliminated the human equation entirely, as the machine itself remains the same for each test, and all that is necessary is to pull the lever on the starting compensator. A thermometer is placed inside the brake drum so that the heat generated by friction can be registered.

Every important factor in braking ability is determined to a nicety. Heat resistance, coefficient of friction, durability, etc. —all are reduced to actual figures. The machine was designed to test different materials and structure of brake linings, and will be utilized to obtain technical reports for the benefit of the sales force of the company. The Waite machine is at all times available to any of the customers or prospective purchasers of Multibestos who care to make tests of brake linings.

A branch has been established at 88 Birnie avenue, Springfield, Mass., by the Mack Motor Truck Company, which distributed the machines of the International Motor Company in New England, which is under the management of E. N. Wright.

H. T. Curtis has been appointed manager of the New England branch of the Invader Oil Company, with headquarters at Boston, and Howard M. Plowman has been made manager of the Philadelphia branch of the concern.

George D. Wilcox has been made manager of the Standard Motor Truck Company, Detroit, Mich.

NEW YORK ELECTRIC AND MOTOR VEHICLE SHOW.

IN MID-AUTUMN, when New York City is thronged with its residents and the flood tide of visiting business people is fullest, one of the events anticipated with much expectancy, and which is an attraction of no mean proportions, is the annual Electrical Exposition and Motor Show. This exhibition is organized by the Electrical Show Company and it is intended to be broadly educational in the use of electric energy for light, heat and power. This show has increased in proportions each year until it has become a national event—national at least in the sense that it is the best demonstration in the nation of the economic possibilities of a utility that is now an actual necessity in practically every community of size in America.

George Fox Parker, Manager, New York Electrical and Motor Vehicle Show.

This exhibit will be made in the Grand Central Palace, Lexington avenue and 46th street, where it was seen last year, and as a show it will be larger and more interesting than ever before. It will be opened Oct. 15 and will be continued until the evening of Oct. 25, during which time visitors will be admitted from 10 in the morning until 10:30 in the evening. It will be exceedingly comprehensive in that it will give innumerable demonstrations of the practical uses of electric energy, as well as its utilization in science and engineering, and these will be of special interest to persons in every phase of life.

Those who associate the use of electric current with lighting and power production will find the exhibition a great education. The utilization of the mysterious force, scientifically developed, will be shown in illuminating, power production, manufacturing, cooking, heating, agriculture, transportation, mining, forestry, telegraphy, telephony, surgery, in army and naval service, in general business and in office use, and in many conveniences and time and labor saving devices that will appeal to men and women. There may be found the elegance desired by the person of large resources or the practicability sought by the most economical: there is what will contribute to health, to comfort, to luxury, to safety and to business facilities and expedition. In every instance it will be shown that the increase of use has brought a corresponding decrease of price, and there will be good reason to believe that eventually electric energy will be utilized as generally in the home as it now is in business.

One of the divisions of the show in which every business man will be concerned is that where electric wagons and trucks will be seen, these being of different types and of sizes suited for every need. The transportation department will include both pleasure cars and service wagons, and these will be displayed by the manufacturers and their agents. The machines will be demonstrated on an oval track 100 yards in circuit on the third floor of the building, and here driving lessons will be given by experts to those who desire instruction before venturing into street traffic.

On this floor will be the model garage, which will be worthy the attention of any person interested in electric vehicle transportation. It will have practical equipment provided by manufacturers of standard battery charging apparatus, including motor generator sets, rectifiers, charging panels and different instruments, and what will make for economy and satisfaction in garaging. Every practical device that will lessen or facilitate labor and afford practical results will be shown in actual use and its value demonstrated. In this garage will be seen all that should be desirable or needed in a public service station, and experts will show the possibilities of whatever is used, from the viewpoint of economy, future expansion and elasticity of accommodation. A complete record will be kept of the operation of the machines, as in actual service.

The garage will be fireproof and aside from the charging apparatus there will be electric vacuum cleaners, air compressors, washing machines, and a battery room where the batteries in use will be given attention by skilled workers. The character of signs generally advocated will be illustrated, and nothing will be left for conjecture or imagination.

Incidentally, the exhibition will have as features a display from the Philadelphia mint, where machines will transform metal into souvenir medals, an electric dairy and poultry farm, a model of a farm irrigated by electric power, a canal display by the State of New York and a model of the Padro Miguel locks of the Panama canal, the latter being sent from the White House at Washington; a model of a United States battleship bridge, and an installation of the new nitrogen lamp, which is a tungsten filament installed in a globe filled with nitrogen gas instead of in a vacuum. These lamps will be placed in the market in a short time. Those to be shown will be of 5000 candlepower each.

The plant of the Victor Motor Truck Company, Buffalo, N. Y., has been purchased by the Clover Leaf Milling Company of that city, and it will be used for milling purposes. The mills of the purchasing concern were recently destroyed by fire.

ELECTRIC WAGON FOR "WHEELBARROW WORK."

COES Wrench Company, Worcester, Mass., a manufacturing concern that has existed for more than a half century, is directed by Frank L. Coes, who has had long experience with different kinds of motor vehicles. He has driven machines for years and has a practical knowledge of automobiles and motorcycles, and for a considerable length of time has used motor wagons for haulage between the two plants of the company and the shipping terminals of Worcester.

One of the vehicles in service is a General Vehicle 1000-pound wagon that is about 11 years old. This machine was originally bought by a concern at Troy, N. Y., and after use for several years it was traded to the maker in part payment for another wagon, and for a considerable length of time was used in New York City as a garage repair and assistance vehicle. Mr. Coes bought it, and after minor repairs, and the change from a tiller to a wheel steer, it was taken to Worcester. It was used about a year for city delivery and was then equipped with an Edison battery and the top cut off and was used for "wheelbarrow work" between the two plants, which are about a quarter-mile apart. The machine is engaged in shifting material from the one to the other constantly.

A One-Ton General Vehicle Wagon 11 Years Old in the Service of Coes Wrench Company, Worcester, Mass.—Frank Coes on the Driver's Seat.

Recently Mr. Coes exhibited the "old-timer" to a number of visitors, and the accompanying illustration was made at that time. Speaking of the wagon Mr. Coes said that it is driven by several persons and no record is made of its mileage or current consumption, but the wagon must be "on the job" all the time. The change of battery was made because of the poor roads and the conditions of use. It carries all kinds of loads, in all weather, and is out of doors all of the working part of the day, being in the garage only at night or when charging. It is frequently run several days with only a noon "boost", for charging is a matter of convenience with the plant electrician.

Mr. Coes says that the wagon is not handsome, but the results obtained demonstrate what can be done with a very old and out-of-date machine with an Edison battery, for so long as the work is done no particular attention is given to it. Aside from filling with electrolyte and painting the outsides of the cells no work has been done on the battery.

As to wagon repairs, what has been done is replacement of a stripped pinion or two when green operators used the reverse for a brake.

The company has in its service a three-ton 1911 White truck and a Ford delivery wagon. The truck has been run daily through two winters and is now in good condition. The machine has been driven more than 30,000 miles and the tires have been renewed all around once, and a new rear set will be needed in about three months. One set of driving chains and sprockets and one set of spark plugs have been worn useless, and the machine has been painted once and varnished twice, this work being done by the company's men, taking advantage of a Sunday and holiday together. The body has been reironed inside because of wear. The total cost of renewals has thus far been less than $200. The Ford machine has been driven more than 5000 miles and has only needed the replacement of two shoes, an old gauge and a windshield glass.

When the gasoline machines were placed in service Mr. Coes inaugurated the "Peter Robinson" system, so-called from the fact that it was originated by Peter Robinson of London, England, and this is the payment of a regular wage for the driver, plus a bonus for each week's service with no repairs and plus a monthly bonus for four consecutive weeks of no repairs. "No Repairs" is defined to mean that no repairs are needed that the driver cannot make, using the shop facilities. Such repairs as the drivers make are made out of hours on all occasions. When the drivers are hired they understand that overloading and fast driving are absolutely forbidden and an infraction of this rule means instant dismissal. When repairs are needed the drivers do the work and receive their bonus. The plant employs an electrical expert and his men do all electrical repairing, and all the mechanical work is done in the

shops of the company. The garages are as well kept as the machine rooms of the plant.

Mr. Coes' comment on his service is characteristic and pointed. He says: "We believe in gas for long hauls and juice for short ones. We have a four-mile trip for outgoing freight, and the same over bad surfaces for incoming freight, and the gas truck is good for five trips a day with an extra lumper or four with its regular crew.

"We believe that the bonus system, with strict living up to the overload and speed rule, will take any commercial vehicle a long way toward satisfactory service in any climate. But we do not believe that the bonus system alone will do anything extraordinary toward truck satisfaction. The trouble with most truckmen is that given a load in view of 1.5 rated capacity, they will make it one trip rather than go twice, even if so doing jeopardizes the truck in every point. Without the bonus system cleaning, foresight of possible troubles, and inspection after washing become merely perfunctory or dwindle into nothingness. With a bonus in view the driver and his lumper become interested; they inspect, test, wash carefully and endeavor to make the truck deliver the service it was built for. The bonus account we consider the best money we spend in our transportation department."

THE A. V. SHOCK ABSORBER.

A Hydro-Pneumatic Spring Device for Eliminating Breakage of Springs.

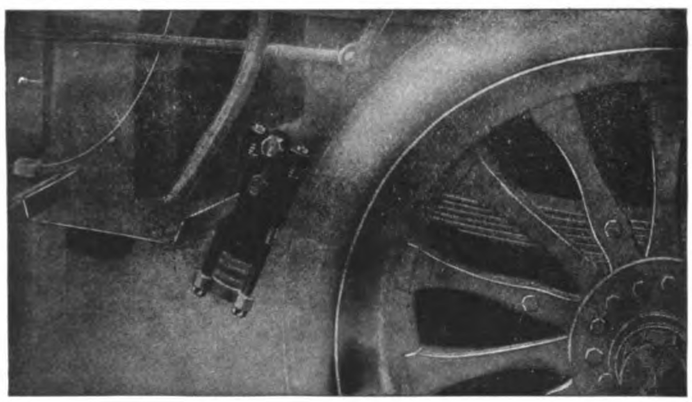
The A. V. hydro-pneumatic spring shock absorber, for which the Hudson Export & Import Company, 140 West 42nd street, New York City, is the sole American selling agent, is a device originated in France and used extensively abroad on both pleasure cars and service vehicles for the prevention of spring breakage and to minimize the effects of road shocks upon the mechanism of motor driven machines. It can be applied to both forward and rear springs.

The shock absorber is a combination of hydro-pneumatic cylinders and supplementary concentric spiral springs which are contained in a chamber. For rear springs there are two communicating chambers and two spiral springs concentric, arranged to replace a spring shackle in tension. The upper spring cover, on top of which is a lug for receiving the hanger, has two concentric cylinder walls, the inner serving as a piston and the outer as a protective sheath. This section also carries a piston that operates within the spiral springs. The lower spring cover carries a third cylinder concentric and telescoping between the other two, and also a cylinder that is concentric with the outer cylinder and into which the piston engages. This lower section also carries four guide stems that are held at the top by a swing bar that is fitted on to the spring bolt. The wall of the central cylinder into which the piston is fitted is perforated with holes of different sizes. The lower half of the absorber is filled with oil.

The movement of the springs will actuate the two parts of the absorber, which is suspended in, or nearly in, a vertical position, either separating or telescoping them. Slight movement compresses the air, which half fills the chamber and the spiral springs, and greater movement will cause the piston in the central chamber to force the oil through the holes in the cylinder wall. As the compression increases the resistance to the piston is more, and as the holes in the cylinder are smallest near the bottom the progress of the piston is resisted until motion ceases. As the pressure is decreased the upward movement of the supplementary springs and the compressed air is resisted by the piston, which must draw through the holes in the cylinder walls the oil that was displaced by the downward movement, and the reflection of the vehicle springs is thus retarded. Obviously the tension of the spiral springs and the rapidity with which the oil can be forced from or drawn into the central cylinder may be graduated to meet any requirement.

The absorbers are made in different sizes for wagons and trucks and may be easily and quickly installed. Being filled in part with lubricant there is negligible wear, and yet as a further protection these may be covered with cases that are dust and water tight.

The absorbers for front springs differ somewhat from the rear equipment in that there is a group of three cylinders, in which spiral springs are placed, and the larger of the three telescopes and the others have springs installed below the pistons. The large and



The A. V. Shock Absorber as Applied to the Forward Ends of the Rear Springs of Motor Trucks.

the small cylinders are connected at the base by passages. The upper section of the large cylinder and a fitting that carries the pistons of the small cylinders are attached to the chassis frame, in the event of a semi-elliptic spring on a pivot. The lower section is attached to the spring eye by the usual bolt. The deflection or reflection of the spring causes the oil to pass from the large to the small cylinders, or vice versa, and the spiral springs take the slight movements and the hydraulic action compensates for the greater motion.

BALL BEARINGS IN ELECTRIC VEHICLES.

By W. L. Batt.

ANY consideration of the design of a self-propelled vehicle must take into first account the operating efficiency of the machine as a whole. When, as in the case of battery propulsion, the source of power is limited, then maximum economy becomes paramount.

The average user of an electric vehicle scarcely appreciates the many points at which a loss of energy in his machine may occur, nor the efforts which have been made by the manufacturer to secure the greatest mileage a battery charge. The liberal use of anti-friction bearings is the most apparent way of realizing the highest vehicle efficiency. Too often, however, bearings of incorrect design and poor mountings are responsible for even a greater loss of power than their omission would have caused.

The modern high grade ball bearing is a most dependable element. It is not only a gradual development of a long period of years, but the result of a series of scientific investigations, by which it was conceived and through which its successful performance was made possible.

As a basic principle the substitution of rolling friction for sliding friction is as old as the history of man. The building of the Egyptian pyramids was probably made possible by such an application and there are in existence today many examples of early foreign construction in which balls or rollers were used.

There was no widespread need, however, for bearings of low power consumption until the advent of the bicycle. Leg fatigue, brought on by wearily pedalling the now ancient velocipede, caused the insistent demand for an easier running machine. Various forms of ball and roller applications served to palliate the evil to a degree.

It was about 1895 when German machine designers, seeking a new efficiency, attempted to make use of the anti-friction bearing for their then comparatively heavy service. Failure followed every attempt. It was assumed as a demonstrated fact that anti-friction bearings were unsuitable for heavy work.

One of Germany's largest industrial organizations, the Deutche Waffen und Munitions Fabriken (German small arms and ammunition factories), believed to the contrary. Arrangements were made with the then famous testing laboratories at Neubabelsburg to take up the entire subject of anti-friction bearings, to investigate without prejudice all forms of ball and roller bearings and their combinations and to report to the waiting engineering world what it might expect. Years of investigation followed. The results clearly demonstrated that more was to be had from what is now known as the annular ball bearing, than from any other type, of either ball or roller bearing.

On the basis of those investigations the DWF first began the manufacture of the modern ball bearing for heavy duty. It is that bearing in a somewhat modified and considerably improved form which made the gasoline motor car possible, and which is being used equally well in the electric vehicle.

When the great number of points at which valuable power may be thrown away in an electric vehicle are considered, it is surprising that more attention has not been given by designers to possible economies that may be effected here and there. There are, roughly, five elements in an electric car at which some power must inevitably be lost. Those are in order:

(1) The motor.

(2) The drive; this may be either by jackshaft and chain or by a longitudinal shaft and bevel or worm gear.

(3) The wheels on their axles.

(4) The friction between tires and supporting surface.

(5) Windage.

The amounts of power lost from these various causes obviously differ in different vehicles and there is a certain irreducible minimum of loss which will not be affected by any care or carelessness of the operator of the car or by its maker. The purpose of this article is to discuss only those losses of power due to the bearings and to show where that loss may be increased or decreased by the builder of the car and where by the user of it.

(1) The Motor—The revolving element of the motor is carried on two bearings, one on the pinion end and the other on the commutator end. This armature revolves at high speed and should always be mounted on high grade ball bearings. The prime advantage of ball bearings over roller bearings is found in their easier and smoother running and in the ease with which the armature can be located endwise by a single bearing. Plain sleeve bearings require an excessive amount of power and entirely too frequent attention, to call for consideration.

These bearings must be sufficiently lubricated and yet there is danger of over-lubrication. A surplus of oil or grease will quickly find its way over into the motor housing, covering the surface of the commutator and soaking the windings. A little attention will show just how much lubricant should be added from time to time to replace that which works out of the housing.

(2) The Drive—There is undoubtedly in the average case a greater loss of power in the drive than in any other one element. Where an exposed chain is used, this is the chief offender, though suggestions without end have been offered with a view to reducing that loss. The bearings on the jackshaft are usually ball bearings and being easily gotten at, may be given the necessary attention, without danger of

an excess of lubricant. Where ball bearings are used, it is very desirable that the mounting should be such as to avoid an overhung load. The bearing should be under the centre line of the sprocket, in order that it may not be affected by the deflection of the jackshaft.

In the case of the bevel or worm drive, there is a very considerable end thrust from the pinion. The best practise calls for the use of a ball thrust bearing in combination with an annular ball bearing for shaft support radially.

(3) **The Wheels**—Current practise is about equally divided between the use of ball and roller bearings for front wheels, though ball bearings for rear wheels seem to be unquestioned.

There is undoubtedly a large amount of end thrust imposed on front wheel bearings, due in part to the angularity of the wheel with reference to the ground, but in large measure to momentum of the car on curves and to the shock of collision with curbings, tracks and such. There is no reasonable doubt but that ball bearings properly selected and mounted may be depended upon for the most severe service.

Unfortunately in the past, small size ball bearings and improper mounting have in many cases caused trouble. This is, however, quite as true of roller bearings. The latter are usually of the adjustable type and if set up too tightly may consume an unbelievable amount of power as well as cut themselves to pieces. The prime advantage of the annular ball bearing is that it is not at the mercy of any man with a monkey wrench.

It is important that care be used that water does not get into the wheel hub and cause rusting of the finely polished bearing surfaces. The hub should be tightly packed with a good grade of clean grease until the grease exudes from around the cap in the rear. Under ordinary conditions a filling every few months with clean grease is sufficient.

With the friction of tires and supporting surface and windage, the ordinary operator is more or less familiar.

That too much care cannot be taken by the manufacturer in his selection and mounting of the anti-friction bearings, and that a little attention to their maintenance from time to time is a paying thing, ought to be evident. The results are directly measurable in increased battery life and decreased cost per mile of operation. That this saving goes on from day to day and year to year should be a spur to the thoughtful designer to use only the best type of bearings, even though their first cost be a trifle higher.

LONG MILEAGE ON SINGLE CHARGE.

Atlantic 1000-Pound Wagon Makes Remarkable Demonstration in Delivery.

A demonstration that is regarded as very unusual, which was made under observation and later sworn to by the driver of the machine, took place in New York City, Sept. 26, when John Savage of Newark, N. J., drove a 1000-pound Atlantic wagon 83.4 miles in delivery work. The Atlantic Vehicle Company has made numerous tests of its machines to determine the mileage with standard equipment under working conditions, and this trial was a continuation of the series, it being made in delivery service for the Riker-Hegeman Company in New York.

The machine is equipped with a battery of 44 13-MV Hycap-Exide cells and a Veeder hub odometer. It was driven from the garage of the Yellow Taxicab Company, East 25th street and Lexington avenue, to four of the Riker-Hegeman stores, where packages were taken on for delivery. Savage was accompanied by a boy helper and two observers. The packages were delivered on either side of the city north of 13th street and south of 97th street. After the last delivery was made one observer and the boy were dropped and the machine was driven from 105 East 15th street to 162nd street and Fort Washington avenue, where the second observer was left, and then the wagon was returned to the garage of the Yellow Taxicab Company in East 25th street.

During the period the machine was on the road it was not charged and when the garage was reached the odometer indicated 133.9 miles. At the start the reading was 50.5 miles, and the indication showed that the wagon had been driven 83.4 miles, on a single charge of the battery. Fifty stops were made.

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The MOTOR TRUCK

Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., NOVEMBER, 1913 No. 11

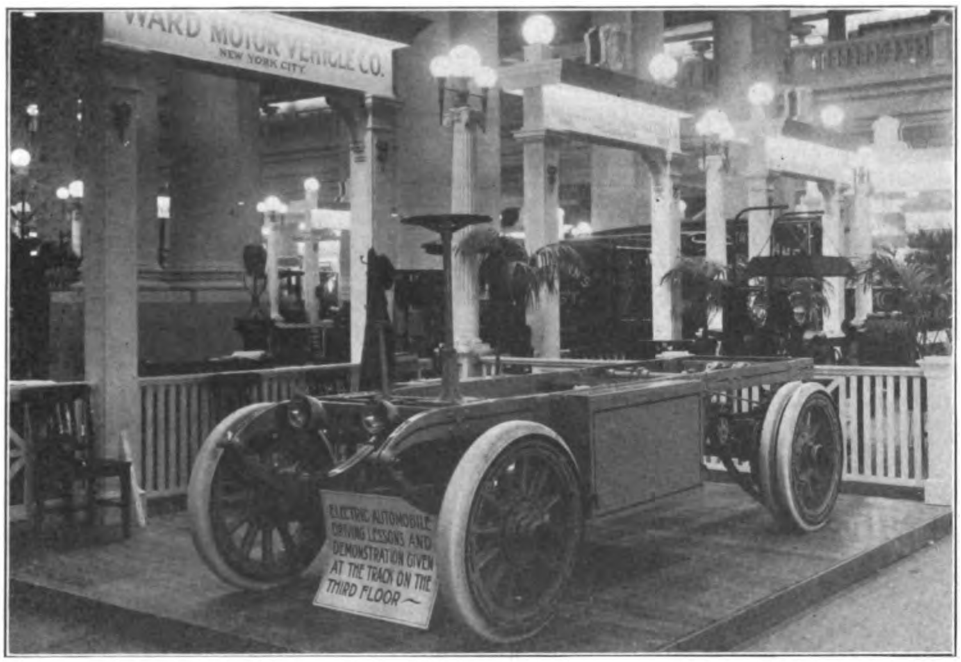
TRUCKS A FEATURE OF ELECTRIC SHOW.

Motor Vehicle Department of the Annual New York Exposition, Only Service Wagon Display of Metropolis, Afforded Gratifying Results---Standard Types of Chassis and No Innovations Characteristics of the Exhibit.

ELECTRIC service wagons and trucks were shown by practically every exhibitor in the vehicle division of the Electrical Exposition and Motor Show, that took place at Grand Central Palace, New York City, Oct. 15-25 inclusive, which was the only opportunity that makers of such vehicles will have, in all probability, for exhibiting in the Metropolis for a year. While there will be a show of pleasure automobiles next January, as has been the custom for the past 14 years, no wagons or trucks will be displayed.

The exposition, from the viewpoint of those who made exhibit, was in every way satisfactory. The degree of interest obtaining in the machines was surprising, and the possibilities with their use were brought to the attention of many thousands who would not have had similar opportunity to learn of them. The Electrical Exposition is an annual exploitation of the advancement of electric science, not only by the residents of New York, but by people in all parts of the country. At these shows every use of electric current for light, power and heat that can be economically made for industrial, commercial and household purposes is demonstrated.

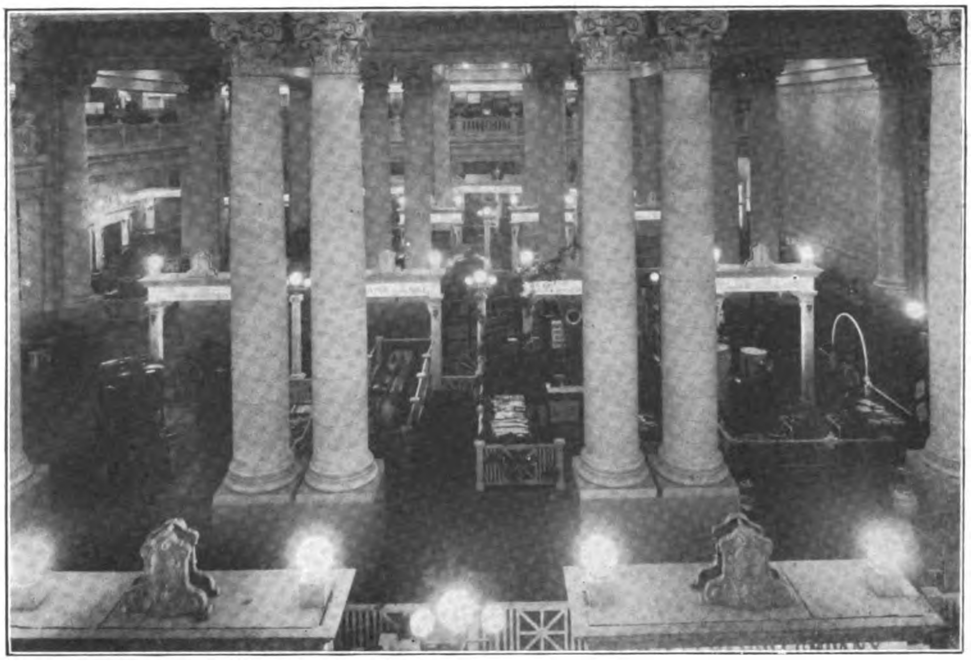
While the number of exhibitors was small, if comparison be made with the great displays of pleasure vehicles, it should be remembered that the great electric manufacturing concerns, those that produce batteries, charging apparatus, motors, controllers and equipment for vehicle and stationary installations, were represented by very large exhibits. Here should be stated that the electric industry is, so far as the building of vehicle motors, controllers and vehicular, garage and service station equipment is concerned, confined to a few very large companies, known thoughout the world as makers of high grade products.



The Stand of the Ward Motor Vehicle Company, a Characteristic Display of the New York Electrical Exposition and Motor Vehicle Show.

The Electrical Exposition attracted many thousands of people daily. While the number actually interested in electric vehicles was but a small part of the whole, the exhibitors, with greater or less experience, without exception stated that the business prospects developed were extremely gratifying.

The show as a whole was spectacular because of the lighting effects, and the attention given to decorations suited for all purposes, and the exhibits included those made by the bureau of forestry of Department of Agriculture, of the bureau of the census of the Department of Commerce and Labor, the Isthmian Canal Commission, the bureau of mines of the Department



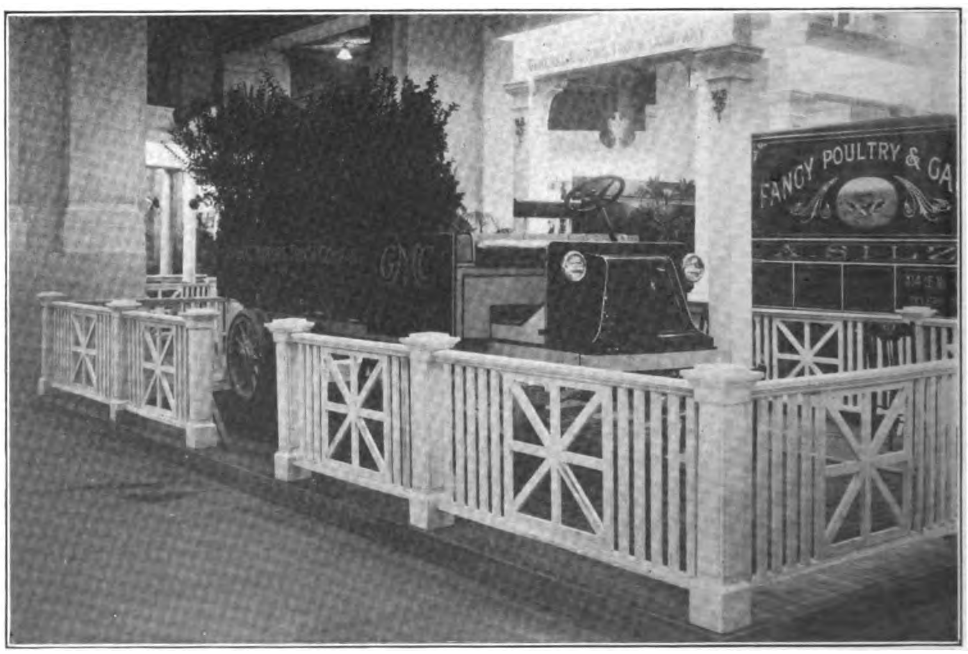
View of the Central Section of the Main Floor of the Grand Central Palace, Showing a Great Diversity of Electric Utilities.

of the Interior, the bureau of standards, the reclamation service, a mint shown by the Treasury Department, as well as elaborate displays by the United States Army and Navy departments; by New York State and by the bureau of municipal research of New York City. Besides a model hospital there were numerous exhibits of apparatus for the administering of electro-therapeutics, and a large number of displays of electric equipment and devices for lighting, heating, household purposes, office work, manufacturing, irrigating, farming and differing means of communication and signalling.

Batteries were displayed by four concerns, three making lead-acid cells and one a nickel-iron cell, and three other companies showed a very wide range of products. Besides these two others showed materials and equipment, and in the model garage was a diversity of productions furnished by a number of makers. The garage was established in the west half of the third floor, with sectional walls built of metal sheathing and wood, to demonstrate fireproof construction. At the entrance and exit of the garage were displayed the signs that have been approved by the Electric Vehicle Association of America.

The garage had a large storage space, a charging panel and rectifiers, and a motor generator set for supplying current. The battery room was fitted with every facility for equalizing, rebuilding, testing, charging and discharging cells, and the machine shop was equipped with a milling machine, shaper, lathe and portable electric drills, and a full set of all necessary hand tools. The General Electric Company supplied a 30-ampere mercury arc rectifier and a six-circuit switchboard. One section of the repair shop was fully equipped for tire maintenance. The garage was designed to show the simplicity of equipment required, the certainty of operation, and the form of installation that, by increasing the units, would meet all future requirements. The educational value of this display was large and the garage was examined by all visitors who were concerned in motor vehicles.

One well informed relative to the vehicles could but be impressed by the fact that there were comparatively few changes in them. In fact there could be no stronger emphasis made of the soundness of the engineering and construction. But one new vehicle, that is, new to shows, was seen, this being the Champion, built by the Champion Electric Vehicle Company, Owego, N. Y., in three sizes, 750, 1000 and 2000 pounds capacities. There is nothing radical in the Champion wagons, the two lighter machines being driven by shaft and the battery being installed beneath the driver's seat. The larger is a conventional type with the battery carried in an underslung cradle, and driven by a double-chain reduction. In careful inspection of



The Exhibit of the General Motors Truck Company, One Standard Chassis Being Sufficient to Demonstrate the Entire Line Built.

Display of the General Vehicle Company, Which Included a Machine for 11 Years in the Service of Arnold, Constable & Co., and the New Worm Driven 1000-Pound Wagon.

these wagons one learns that there is nothing experimental utilized. The designs have been carefully developed and along engineering principles that have been well established by experience and practise. These machines have been built of high class material and of components produced by the manufacturers of standard products, so that there is assurance that the purchaser will always have available in the event of need the resources of the best known concerns in the industry instead of those of a single concern.

The Champion company has built the vehicles that might be demanded by the greatest number of concerns, especially those required for comparatively light and quick delivery, and these in chassis details are in accordance with approved practise. The bodies are built to meet the requirements of the buyers.

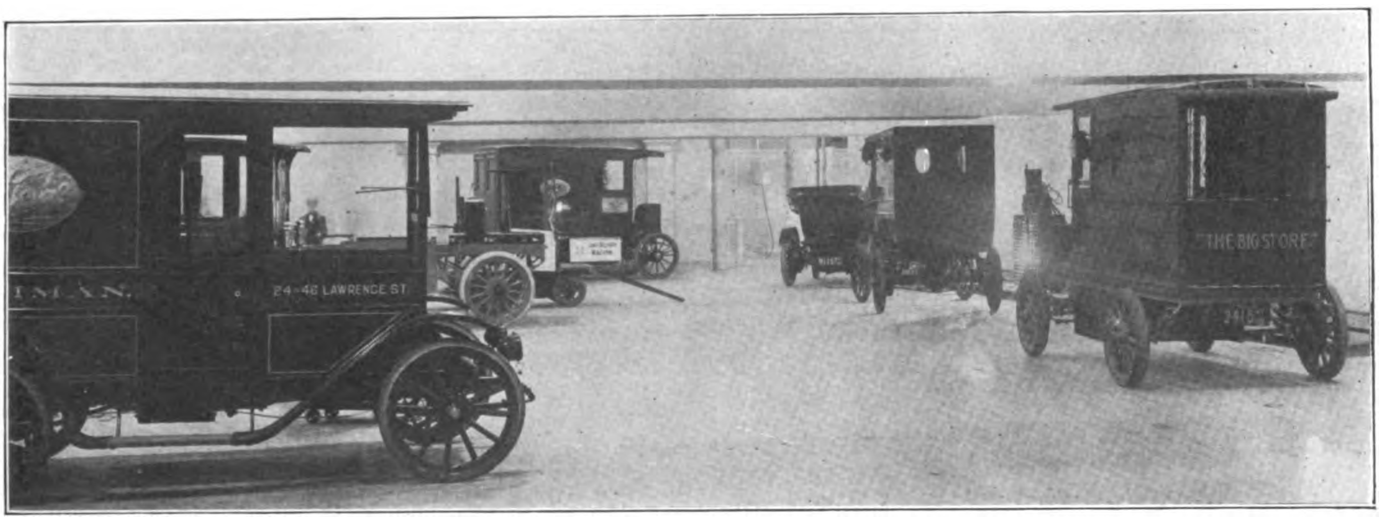
The General Vehicle Company showed for the first time the new shaft driven (worm and gear wheel) machine that is described in another section of the magazine, and this was seen as a stripped chassis and with a panel body. Next to this was seen one of the General Vehicle wagons of 1000 pounds capacity that has been in the service of Arnold, Constable & Co., a widely known New York department store, for more than 10 years, and with a refinished body the old machine was not only sightly, but was exceedingly attractive. This showing afforded comparison of design and construction, and was surely a satisfactory demonstration of the endurance of the electric.

The General Motors Truck Company displayed a single electric truck chassis, this being built to a standard design that is adopted for both wagons and trucks, this having the flexible shaft drive from the motor to the jackshaft and the reduction by side chain. With this design the battery is carried above the chassis, under the seat of the driver, and the instruments, controllers, etc., are protected by a small hood ahead of the dash.

The display of the Ward Motor Vehicle Company was a single chassis, this being the standard design that was adopted a year ago and which has been continued without change. This machine is the careful development of an experience of more than a decade.

The showing of the Couple-Gear construction was a converted horse brewery wagon that had been in use for a number of years and had been adapted by the installation of a fore body containing a battery, mounted on two Couple-Gear wheels. This method of conversion has been the vogue for a long period of time and has been demonstrated to be practical and economical.

The exhibit of S. R. Bailey & Co. was of a chassis that is utilized for passenger cars as well as light service wagons, and a machine was shown that had been

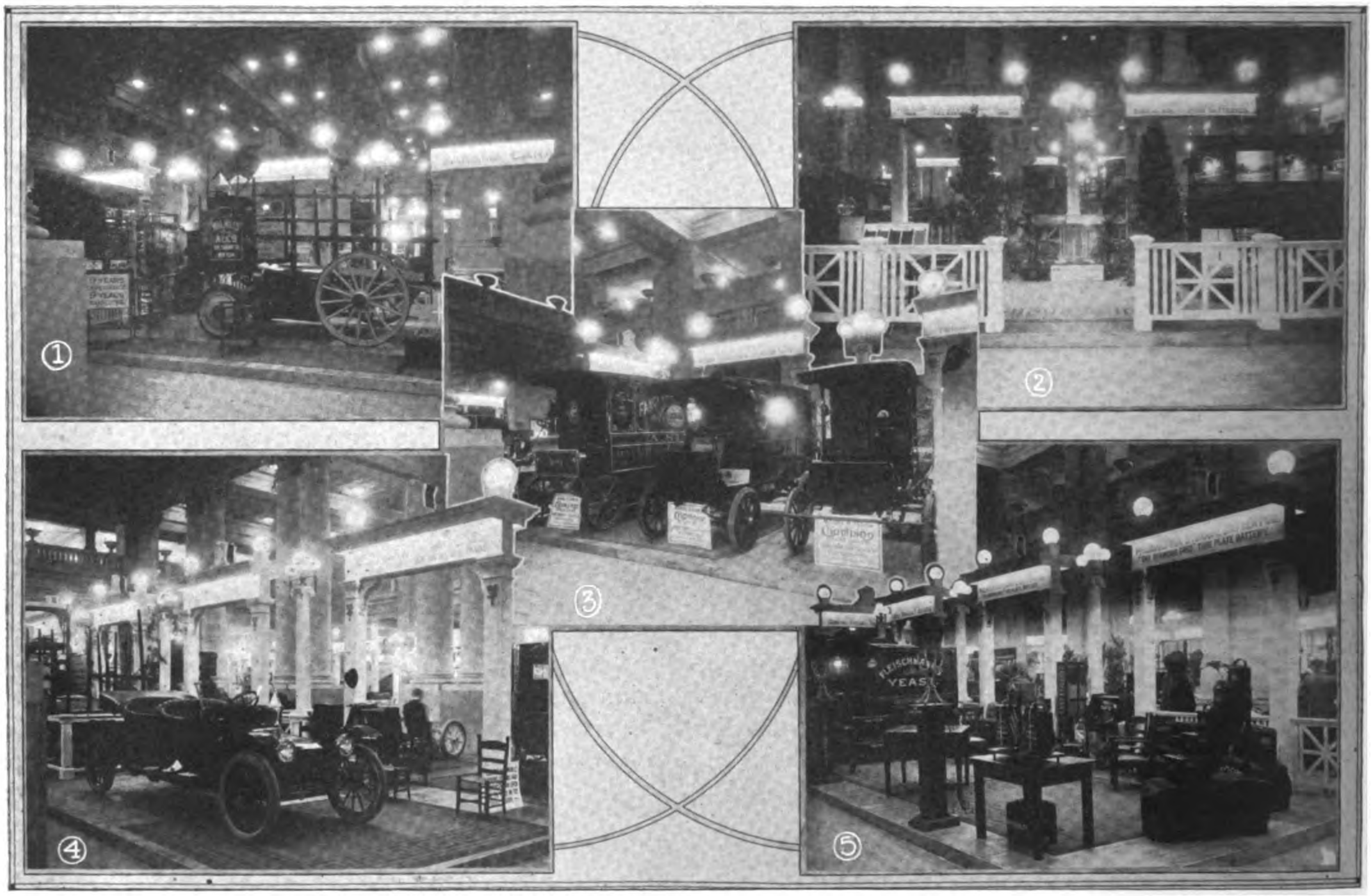


Section of the Model Garage on the Third Floor of the Grand Central Palace, Fitted with Every Facility for Efficient and Economical Care and Maintenance.

driven from Boston to New York by Col. E. W. M. Bailey at an average speed of 21.5 miles an hour, including all time required for meals and recharging the battery. In this same car Col. Bailey left the Grand Central Palace at noon Oct. 19 and drove to Chicago, much of the time through severe rain that made the roads very heavy.

The pleasure cars shown were displayed by S. R. Bailey & Co., and by the agent for the Standard Electric Car Company.

Besides the machines shown in the exhibition spaces there were numerous types and sizes seen in the garage, where they were to be found when not operated on the demonstration track. This track was also used to instruct owners and operators in controlling the machines before permitting them to venture into traffic.



Some of the Exhibits That Featured the Grand Central Palace Show: 1, the Converted Horse Wagon-Truck Shown by Clarence E. Smith & Co., Couple-Gear Agent; 2, the Stand of the Electric Storage Battery Company; 3, the Exhibit of Champion Wagons Made by the Henry Tobin Company; 4, the Display of S. R. Bailey & Co.; 5, the Exhibition by the Philadelphia Storage Battery Company.

The exhibits of the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Wagner Electric Manufacturing Company were of very general character and included many utilities besides those that could be used or required with electric vehicles, while the Electric Storage Battery Company, the Philadelphia Storage Battery Company, the Edison Storage Battery Company and the Gould Storage Battery Company exhibited different types and sizes of cells, both in and out of trays, sectional cells and parts, and by different apparatus demonstrated capacity, endurance and the different qualities claimed for the batteries.

One of the interesting displays was that made by the Rhineland Machine Works, which included ball bearings suitable for electric vehicle construction, and the H. W. Johns-Manville Company at its exhibit showed a number of vehicle and garage accessories and fire extinguishers.

The traffic department of the Automobile Chamber of Commerce has announced a new rate for freight to California that has been fixed by the Transcontinental Freight Bureau to become effective Dec. 1, in which there is a reduction of 50 cents a hundred pounds on motor wagons, which are now billed at the same rate as passenger cars, and mixed carloads, both passenger cars and wagons, will be received if the aggregate weight be sufficient. The minimum weights are 10,000 pounds for a 36-foot car, 10,000 pounds for a 40-foot car, and 12,000 pounds for a 50-foot car.

The Sewell Cushion Wheel Company has established itself in a larger and more commodious factory at Gratiot and Beaufait avenue, Detroit, Mich.

E. S. Thompson, formerly department manager, has been made sales manager of the Motz Tire & Rubber Company, Akron, O.

CLEANING SEWER WITH A MOTOR TRUCK.

Large Economy from Use of a Chassis and Specially Designed Equipment That, with Crew of Three, Replaces Six Carts and 12 Laborers in Service at Pawtucket, R. I.

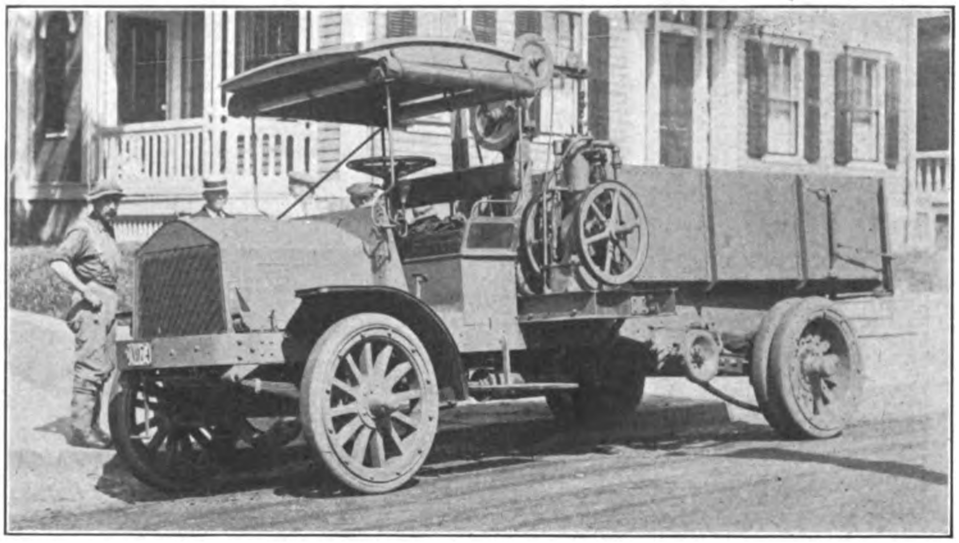
ONE of the problems that each progressive municipality has to deal with is that of satisfactory drainage, and the best system of sewerage is not effective unless it is in condition to carry off the water that may accumulate from rain or melting snow. To dispose of the surface water sewers are constructed, with frequent basins for collecting water, and these are usually bottle shaped and covered, with an opening at the level of the roadway and a manhole for cleaning. The outlets from these basins are generally at about half the depth and are covered with hoods, with traps in the outlet pipes to prevent gas and odor from arising. The basins are several feet deeper than the outlets, to prevent sand, dirt and street refuse washing into and obstructing the sewers, and these basins collect accumulations that must be removed from time to time.

The cost of cleaning the catch basins is considerable, according to the locality and the flowage of water, the manner of working, the distance of cartage, the wages, the method of inspection, etc. In Boston, for instance, the cost of cleaning a basin is approximately $5, and of this as much as 40 per cent. is paid for inspection. The work is usually done by shovels and buckets, and the carting by horses and carts. The basins vary in capacity, but the average will contain about three cubic yards of material, and this is a large load for two horses. With hand cleaning when a basin is well filled the sand must be removed with spoon shovels until a man can enter the manhole. If there is water in the basin the hood of the outlet must be removed and the water bailed into the outlet. Then the solid matter is shovelled into buckets and raised to the street and placed in the cart. Under ordinary circumstances two men, one of them a driver, is necessary with each cart, and inspectors are required for a certain number of carts, this depending upon conditions.

The City of Pawtucket, R. I., now has in the service of its department of public works a Standard truck chassis specially equipped for catch basin cleaning that is probably the only equipment of its kind in America, and it has proven a decided economy in that it has replaced six two-horse carts, and its crew of three men do the work of 12 laborers, saving at least a third of the expense of the work previous to its installation.

The use of the machine was decided on after careful observation of the possibilities, and the detail of the equipment was worked out by the foreman of the city's garage, a mechanic of unusual ability and skill. The truck is fitted with a steel dumping body that is lifted by a hydraulic hoist operated by the engine, and on the chassis back of the cab is carried a two horsepower motor that drives a crane hoist and a water pump by which the manholes are emptied. The body has a capacity of 87 cubic feet and the machine without load weighs 10,600 pounds. The body and mechanism weigh about 3000 pounds and largest load that has been carried weighed about 7800 pounds.

The city has about 1100 sewer basins to clean and there are few available places for dumping the loads. The longest haul is approximately 2.5 miles. The working day is nine hours, and as no work was done when rain fell, much of the time of the horse outfits and crews was given over to haulage, two carts usually working at a single basin so far as this could be done. The increased capacity of the truck and the greater speed in hauling were regarded as the principal factors to recommend it, and the hoisting and pumping apparatus installed was with a view of facilitating the working of the men and minimizing standing time.



The Standard Truck in the Service of the Department of Public Works, Pawtucket, R. I., Specially Equipped for Catch Basin Cleaning, with Dumping Body Lowered.

In the equipment of the truck care was taken to so install it that the chassis was not drilled, all parts being clamped to the frame, and when desired the body and hoists may be removed and the machine can be utilized for any other purpose. The body is of steel plate and angle steel and is 27 inches deep, 108 inches length, 48 inches width at the forward end and 57.5 inches width at the rear end. The ends are covered for two feet with splash plates to prevent the contents, if liquid, from being thrown out. The end gate is a

steel plate and when it is closed it is made practically water tight by the use of heavy rubber gaskets. The body can be elevated so that the floor will incline at an angle of 40 degrees, and the contents discharged by gravity.

Back of the cab and forward of the body is a space 27 inches width on which is installed the mechanism. In the centre is the cylinder for the hydraulic hoist, and this is carried by a frame of two parallel six-inch I beams with cast steel cross members. The frame is 84 inches length, the ends projecting the same distance that do the hub caps. This frame is clamped to the chassis frame. At the left end of the frame is mounted a two horsepower Fairbanks-Morse single-cylinder, two-cycle motor, there being slots in the frame cross members so that it may be adjusted longitudinally. This motor is cooled by the cooling system of the main engine. A pipe connected with the base of the radiator carries the water to a point directly below the small

The Specially Equipped Standard Truck and Its Crew Removing Accumulations from Street Catch Basins, the Bucket Being Lowered After Dumping.

engine and a small pump circulates it through the cylinder; thence the water is carried by a pipe to the rear cylinder of the main engine and forced through the cylinders and the water manifold to the radiator, this providing a means of keeping the main engine warm in the event of cold weather and a stop of considerable length. The exhaust pipe from this motor is connected with the exhaust pipe of the main engine.

On the centre of the frame is mounted the upright hydraulic cylinder. This was built of a section of heavy pipe, a base being cast and welded to the pipe. The piston is forced upward from the bottom of the cylinder and the piston carries a large rod that operates through a stuffing box and a tightly fitting plate. This rod carries a cross arm or head, on the ends of which are large deeply grooved pulleys. Attached to the front of the cylinder and near the top is a pulley at right angles to those carried on the cross arm, and around this is passed two turns of the cable, the ends being carried through the pulley flange and over the pulleys on the cross arm, and down to the ends of the two cast steel arms that are attached to the front of the body, and which drop at either side of the cylinder when the body is lowered. As the piston moves upward the pulleys on the cross arms turn and the body is lifted. The piston can be operated at a pressure of 220 pounds, and when the top is reached the oil used by-passes, but the piston will descend in about 15 minutes time if the engine is stopped. By a release, however, the body can be dropped in about 20 seconds.

The hydraulic pump is beneath the cylinder and it is operated from the transmission gearset of the chassis. An opening was cut in the gearset case and a bronze case was fitted. This case carries the end of the hoist pump shaft, on which is a pinion that meshes with the intermediate speed gear of the gearset. This shaft extends backward and the rear end is carried in a bearing carried on a frame cross member. At the rear end of the shaft is a sprocket that is coupled by a chain with the hoist pump. The hoist is operated by a hand lever at the right of the control levers in the centre of the cab floorboard, and this engages or disengages the shaft pinion with the intermediate speed gear. The driver can, without moving, hoist or lower the body.

On the main shaft of the auxiliary engine, which extends inboard to a bearing near the centre of the frame, and close to the engine, is a keyed-on sprocket that carries a link chain that drives a countershaft below the frame, and this countershaft extends to the right side of the chassis frame. This shaft operates a train of gears on the right side of the frame that carry a shaft on which is a clutch, and this in turn operates a shaft carrying a drum on which a cable is wound. By means of an idler gear the hoist can be reversed. Mounted on the frame is an upright of steel angle with a fitting at the base and top that carries the tubular upright of the crane, and from the head of this tubular member extends an angle steel arm. This arm is strengthened by a diagonal support from the upright to the arm of the crane. On this arm, directly above the upright, is a grooved pulley carried on a standard, and between the angles of the arm at the outer end is mounted another grooved pulley. The cable from the drum drops below the frame, is carried under a grooved pulley below the crane standard and through the standard and over the two pulleys on the arm, the end of the cable being attached to a snap hook. This hook carries the bucket.

At the right side of the chassis, back of the crane, is a small folding platform, and between the sections of the platform, as is shown in the sketch, is a lever that is connected by linkage with the clutch on the

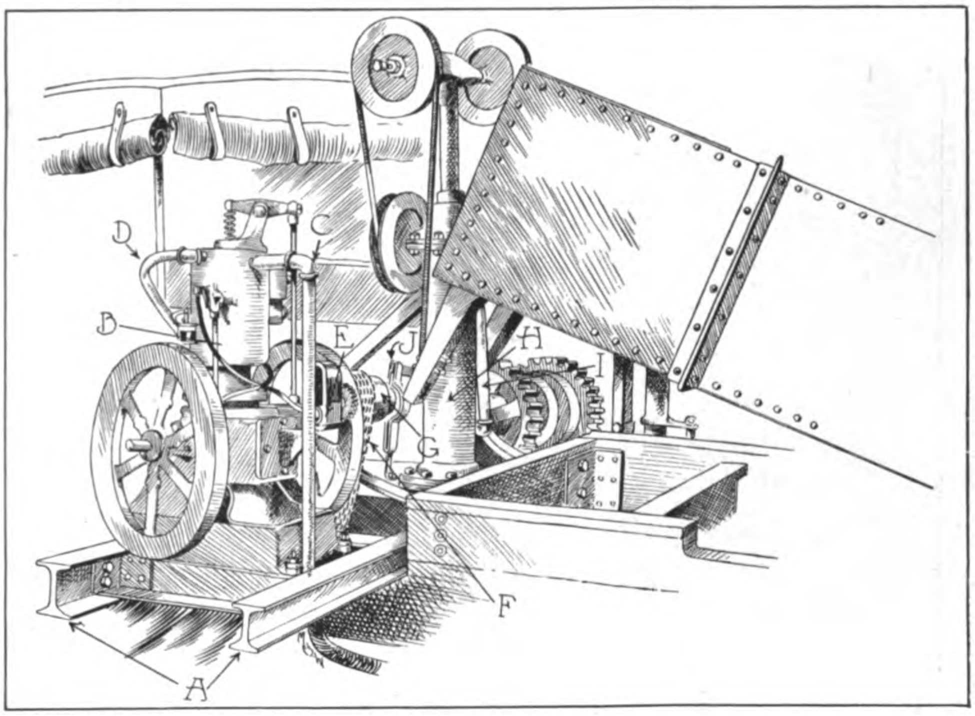
countershaft. When the lever is upright it is in a neutral position. Moving it backward will start the crane hoist and moving it forward will reverse it.

Carried beneath the frame at the right side is a centrifugal pump with capacity of 70 gallons a minute. This pump is driven by the auxiliary engine through a clutch on the engine shaft that drives a silent chain that couples it with the pump shaft. The pump shaft is transverse of the chassis and is above the main driving shaft of the chassis. The pump is fitted with a permanent funnel and a hand pump for priming, and two sections of hose are coupled to it, the one to the inlet, carrying a globe strainer, and the other a regular coupling. The pump is bolted to a cast steel cross member of the frame and is supported by truss rods that may be adjusted with turnbuckles. This prevents any possibility of damage from vibration. The pump is operated by a lever that is installed directly over it, so that the driver may work conveniently. All moving parts are amply lubricated.

The intention is that the truck shall always be worked with the right side to the curb or sidewalk. When driven to a basin the main engine is stopped and the auxiliary started. As the small motor can be driven at a constant speed, and the provision for cooling and lubricating are entirely adequate, no special attention is required. When the truck is moving the crane is locked so it will not swing. When the truck is located for work it is so that the crane will swing over the manhole. A lever at the base of the crane is used to swing the arm as desired, for with varying camber of street surfaces and the weight of the bucket this could not be conveniently done otherwise. The bucket used is of heavy metal and has capacity of about 1.60 cubic feet. When filled the bucket weighs about 200 pounds. As the bucket can be hoisted and emptied by a trip cord as quickly as it can be filled it will be seen that a great deal of time can be saved, the limitation being the shovelling of the one man who can work in the catch basin. When the work is done by hand small buckets must be used, for these must be drawn to the sidewalk by hand and then lifted to the height of the cart body and emptied. This of necessity is slow and hard labor. By the use of the pump a basin can be quickly cleared of water, and with the hydraulic hoist the body can be dumped in a very short time.

The truck can carry approximately three cubic yards of material. As many as 10 basins have been emptied in a day. The mileage is comparatively short, but about 15 miles daily, and yet the hauls are made with very little lost time for the men. The installation of the auxiliary engine minimizes the cost of fuel, for the main engine can be used merely for driving the truck and dumping. The auxiliary power is sufficient for all requirements. The small motor has been driven with kerosene, and it is probable that for next season this fuel will be generally, if not always, used for it.

The comparatively small mileage minimizes the cost of tires, the fuel expense is low, and the statement is made by the department of public works that the basins are cleaned for about two-thirds of the cost with horses, carts and hand labor. The truck body and equipment may be removed with the approach of winter and the chassis can be utilized with another body for other purposes.



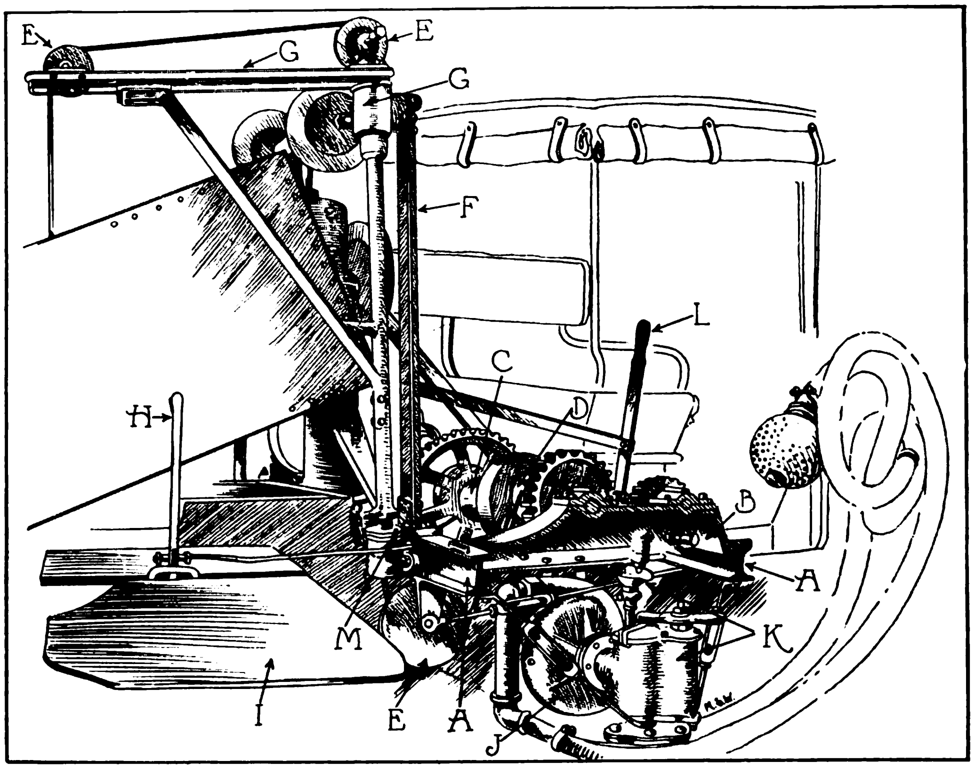
Catch Basin Cleaning Truck, Left Side, Showing Auxiliary Engine and Hydraulic Hoist: A, Frame Carrying Auxiliaries; B, Two Horsepower Two-Cycle Motor, Adjustable on Frame; C, Exhaust Pipe Connected with Main Exhaust Manifold; D, Water Outlet Connected with Rear Cylinder Unit of Chassis Motor; E, Bosch Low-Tension Magneto; F, Silent Chain Driving Water Pump Shaft; G, Water Pump Driving Clutch; H, Hydraulic Hoist Cylinder; I, Hydraulic Hoist By-Pass; J, Water Pump Clutch Lever Linkage.

The equipment was entirely experimental, the material was purchased in different places and patterns were made and parts cast and machined, so that while the work was done in the shops and at minimum cost, the expense of building was a great deal more than if the design were standard and the equipment produced in quantity. The expense was about $1500 above the cost of the chassis. As the city has a well equipped garage and shop, and competent mechanics, whose capacity may be judged from the construction described, it is expected that the life of the truck will be much longer than the average. As a practical, labor saving machine the truck has a great deal to recommend it to the attention of every municipality having similar work.

The utility of the truck and its equipment does not

appear unless one has some knowledge of the work and the possibilities for economizing. To illustrate, the supervision of the work is not now necessary. The driver of the truck is each day given a list of the basins that he is to visit, and these are generally grouped. When a basin has been cleaned a record is made of the material removed, which is measured in the body of the truck by a gauge stick, the capacity of the body having been determined by water measurements. And if, for instance, three basins are cleaned for a single load, the quantity taken from each is known, as well as the total. The truck carries the material to the dump, where a report is made of the work performed each trip. The daily and weekly report is made to the office of the department, and the record kept complete. The detail of operating expense is also recorded with care, and as the department has a number of motor cars and wagons to maintain in its garage the system of maintenance is well planned and is economical.

The experience has been that the cleaning of the basins is necessary in the spring, and in the event of a severe storm in some localities, but the belief of the department is that a great deal of the time of the truck can be devoted to haulage for the water department, and by removing the body and hoist and the installation of a platform it can be quickly converted. Where the requirements are greater than they are in Pawtucket permanent equipment might be desirable, but as there would be little difference in cost and no loss of efficiency, the convertible apparatus is to be preferred, for its utility for other service is preserved.



Right Side of Catch Basin Cleaning Truck, Showing Crane Hoist and Water Pump: A, I Beam Longitudinal Members of Equipment Frame; B, Cast Steel Cross Members of Equipment Frame; C, Countershaft of Crane Hoist; D, Crane Hoist Cable Drum; E, Grooved Cable Pulleys; F, Angle Steel Crane Mast; G, Steel Tubular and Angle Standard and Arm; H, Crane Operating Lever in Neutral Position; I, Folding Footboard; J, Water Pump; K, Water Pump Priming Funnel and Priming Pump; L, Water Pump Operating Lever; M, Crane Arm Lock.

HOLT TRACTOR WINS $15,000.

Sixty Horsepower Caterpillar First in Argentine Traction Engine Trials.

The Argentine Confederation government has stimulated agricultural machinery development and use by competitive trials held at different places in the nation for several years. The Holt Manufacturing Company of Stockton, Cal., and Peoria, Ill., won the chief 1913 honor, notification being given that concern by cable that the 60 horsepower caterpillar gas tractor entered by it in the Argentine Traction Engine Trials had received the award of the first prize.

The competition was this year at Magdalene, and the committee of awards was presided over by the Director of Agriculture, so that the event was in every way of national consequence. In the trials 12 tractors were worked, these being entered by American and European manufacturers, and the first four prizes were carried off by the American machines, while the fifth was awarded to a French firm. The importance attached to the competition may be judged from the prizes, the first of which was $15,000, the second $10,000 and the third $5000. This is the second year in succession that the Holt company has won this competition, and both years the Holt caterpillar has been regarded as superior to all others.

The articles defining the regulations of the contests specify that the purposes were "to determine suitable traction power for the economical future of the province; thus putting the farmer in the right drift for the purchase of such mechanisms as their industries require". The Holt caterpillar tractor this year won the traction engine contest at St. Petersburg, Russia, and so satisfactory was the showing that the Russian government immediately ordered two machines for military purposes. This was a very satisfactory recognition of the qualities established by the award of the judges.

J. R. Callum, who has been identified with the automobile industry and trade for eight years, has organized the J. R. Callum Company and established a place of business at 708 Granby street, Norfolk, Va. The company has the agency for Alco and Sanford machines, and also carries a line of tires and automobile supplies and accessories.

MODELS C AND CX ERGON MOTORS.

THE Hazard Motor Company, Rochester, N. Y., is now building three sizes of Ergon motors, the original production, having bore of 4.375 inches and stroke of six inches, being known as model D, and two new models designated as models C and CX, these having cylinder bore of 3.75 inches and four inches respectively, and stroke of 4.5 inches. Eight types of these three sizes are built.

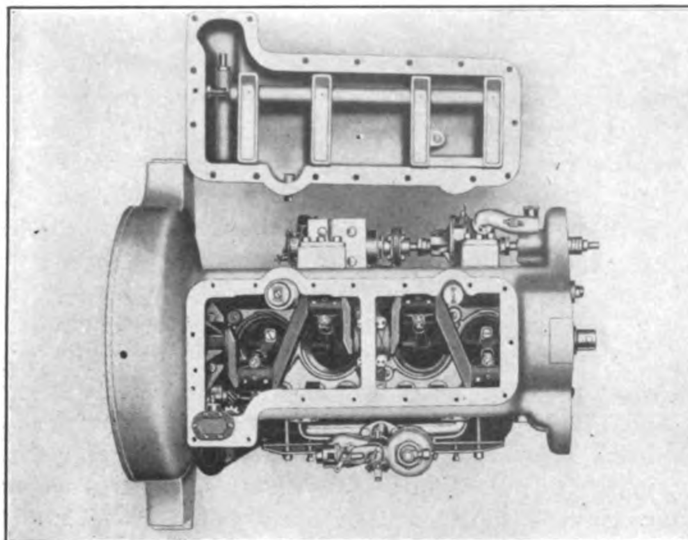
The new designs have numerous features, being exceedingly simple in construction, all working mechanism being fully protected. The motors are supplied as complete unit power plants, as single engines for main or sub-frame installation, or with flywheel and flywheel housing, so that any type of unit power plant clutch and transmission gearset may be used.

Accessibility has been carefully studied and the motors have been in every way simplified. By the removal of the oil pan, which can be done without breaking any connection aside from the removal of the oil strainer in models C and CX, the crankshaft and connecting rod bearings can be exposed. The front cover plate and the support for the starting crank can be taken off without removing any other part, and with the unit constructions the clutch and the gearset can be removed without taking out the motor.

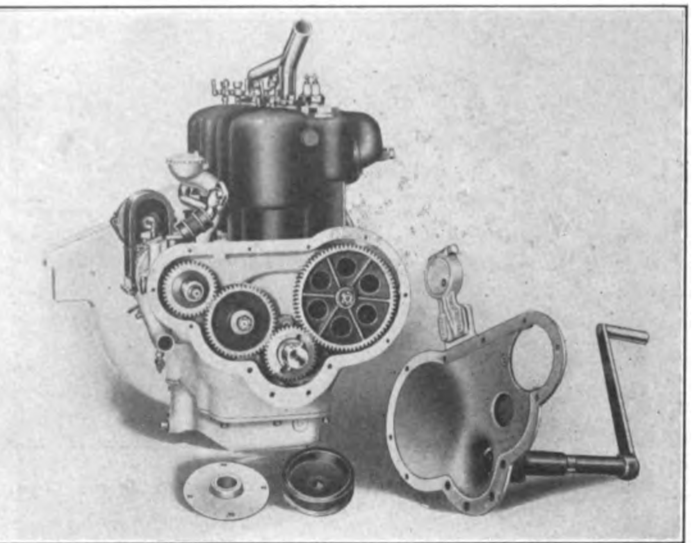
The cylinders are an L head type, cast in pairs, having liberal water jackets, and the units are cast with side and base webs at the valve sides forming pockets for the protection of the valve stems, springs and tappets. These pockets are covered with plates that are retained by wing nuts and are easily removable. The centres of the units have large openings for the caps that carry the water outlet manifold.

The cylinder units are bored, reamed and ground carefully to size and the pistons are turned and ground to accurate fit, so that these are interchangeable. The pistons are fitted with four rings, one of which is at the wristpin, the rings fitting into the ends of the pins and preventing movement, as well as sweeping lubricant into the hollow pin centre. The crankcase is a barrel type, cast from a special aluminum alloy, and the bottom is a cast iron tray or pan that is attached to the case by studs, nuts and lock washers. The use of the cast iron insures extreme rigidity and strength. At either side at the rear of the case are strong supporting arms cast integral with the flywheel housing, and suited for either main or sub-frame installation. With the model D the forward support is a trunnion that is fitted to a bracket carried on the chassis or subframe, but with the models C and CX the support may be the trunnion on the cover plate through which the starting crank is passed, or it may be a boss on the bottom of the front end of the crankcase, ahead of the oil pan. From the illustration the construction of the oil pan may be noted.

The engine has three long main bearings, the centre bearing being installed in a substantial transverse web. In these is carried the crankshaft, which is made of a high grade carbon steel drop forging having a tensile strength of more than 90,000 pounds. The shaft is carefully machined and ground. This is mounted in bearings that have a total length of 8.75 inches for both sizes of motor, and these are each secured by four bolts. The camshaft has also three bearings of liberal diameter and length, and is carefully finished. The crankshaft and the camshaft are carried on die cast babbitt bearings, save the forward end of the camshaft, which is on phosphor bronze. The connecting rods are drop forged from a high carbon steel and are heat treated. The timing gears are helical cut and are of wide face. The camshaft is driven direct from the timing gear of the crankshaft, but the countershaft is driven by an idler gear. The gears operate without noise at all times.



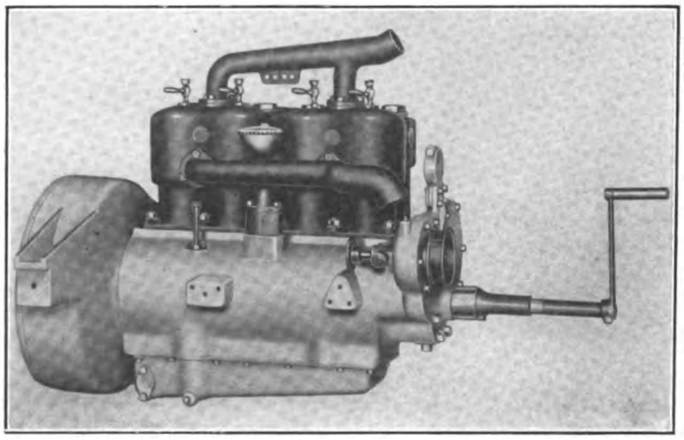
Bottom View of Model C Ergon Engine, Showing Oil Pan Detached.



Front View of Model C Ergon Engine, Showing the Timing Gears.

The valves are large and have a liberal clearance. They are made of cast iron heads electrically welded to carbon steel stems. The valves move in long bushings that serve as guides. The valve tappets are a mushroom type and are operated in guides mounted in the web above the base flange. The tappets are fitted with usual means of adjustment for wear. The lubrication is by means of a pump that maintains a constant level in the oil pits. The oil is pumped through a filter to these pits and the big ends of the connecting rods carry scoops that lift and distribute the lubricant to oil pockets that supply the main bearings and the timing gears, as well as lubricating all the bearings of the camshaft, the wristpins, the valve tappets, cams and the piston and cylinder walls. The quantity of oil in the reservoir is indicated by an indicating device that is visible when the hood is raised.

The cooling is by a circulation of water through the large water spaces of the cylinder units, by means of a centrifugal pump driven by the countershaft, the impeller being a hard die-cast metal that has great endurance. When thermo-syphon cooling is used the



Right Side of Model C Ergon Motor, with Manifolds for Thermo-Syphon Water Circulation.

motor is fitted with larger cast iron water manifolds that are sufficient to insure a free movement of the water. The water manifolds are of a special alloy of steam brass that insures a close grained casting that will be free from leaks. The intake manifold is of aluminum and the exhaust manifold is cast iron. Provision is made for mounting the magneto on a bracket at the right side of the motor, where connection is made with the countershaft by a flexible coupling, the magneto rotating clockwise. Both magneto and water pump may be easily removed should this be necessary.

Much care is taken to balance the motors. The flywheels are first tested off the shaft and again when assembled with the crankshaft. Each engine is tested under its own power and after the test is given an overhaul and again run for several hours. A very efficient and thorough inspection department is maintained, and all machined parts are inspected after each operation. Assemblies are carefully watched and great care is taken that the engines shall be sent out free from faults and imperfections.

The motors can be fitted with different carburetors and magnetos, and flywheels are supplied for all styles of disc and cone clutches. The model C motor is rated at 20-25 horsepower and the model CX motor at 25-30 horsepower. These motors are fitted with a centrifugal type of throttling governor that is contained in a connection that is mounted between the carburetor and the fuel intake manifold. A butterfly valve is contained in this connection that is operated by means of a rack and pinion, the latter being attached to the throttle disc. The governor weights and spring are mounted on the camshaft front gear, the motion from the governor to the butterfly valve being transmitted by a swinging yoke connected with the rack by a stiff steel rod. The action of the governor is positive and adjustment can be made when desired. The governor is not supplied as equipment, an additional charge being made for this.

HAULED 666,000 BRICK NINE MILES.

Hauling 666,000 brick nine miles may not appear to be a large undertaking, but the Frank S. Parsons Company, Northampton, Mass., making contract for this work, abandoned horses and made a profit in a single season that more than paid for the cost of the Reo two-ton wagon bought specially to do this job. The company made the contract to haul the brick from Northampton to Amherst, a distance of nine miles, and after consideration bought a Reo chassis. A platform body was built of rough scantling and boards in three hours at a cost of $6. Then the work was begun.

The wagon with the body weighed 4460 pounds. A load was made of 1250 bricks and four round trips were made each day, the total of 72 miles being covered daily for 133 days and two hours, when the last brick was delivered at Amherst. The average fuel used was nine gallons daily, and .66 quart of oil was consumed, which, at 30 cents a gallon for oil and 18 cents a gallon for gasoline totalled $1.82, and this, with the driver's wage of $2.50 a day, made the daily average expense of operation, aside from fixed charges and repairs and maintenance, $4.32.

Very accurate record was kept of the work done and the cost of operation and upkeep, because the company was desirous of learning what was possible, and because few persons believed that a machine could be operated as productively in this work as horses. The owners have found the wagon paid for itself with the brick contract alone, to say nothing of profit from other work done as demonstrations. The machine is now in daily use and has little evidence of a hard season's service.

Frederick E. Gooding has been made assistant manager of the truck sales department of the Willys-Overland Company of Toledo, O., and will have charge of the sales of the Willys Utility wagon, made at Lima, O.; the Garford trucks, made at Elyria, O., and the Overland delivery wagon, made at Toledo, O.

VALUE OF TIME IN HAULAGE SERVICE.

Record of Daily Work of Each Vehicle and the Cost, Afford Knowledge Through Comparisons That Make for Really Productive Transportation Economy.

WITH the study of transportation by highway vehicle the fact that vehicles should be worked as much of the time as is possible is more strongly emphasized. It is not a new condition, but it is the application of an old idea to work that has never before been regarded from the viewpoint that its importance demands. When the cost of haulage was generally unknown the possibilities of economy were never seriously considered, but there is no reason why the time of men and vehicles should not be conserved to the same extent as is labor and the use of tools, apparatus and facilities in manufacturing or in commerce.

The economy of time is sufficiently understood so that no argument need be made, but the demand that has made possible the enormous development of railroads, of steamship lines, or machine production, has been turned to highway haulage because of the greater speed and carrying capacity of motor vehicles as compared with animals. Those who have given thought to statistics and made estimates based on incidental observation realize that the cost of transportation is enormous, and that even the reduction of a very small percentage would be a saving that in the aggregate would reach an astonishing sum.

As the nation, the states and the municipalities and even individuals are contributing large amounts of money toward the improvement of the principal highways, and the cities and towns are constantly bettering the condition of streets, there is every reason why there should be some practical realization from the expenditures, and this cannot be done unless the roads and thoroughfares are used. There is no doubt that American highways are far from being the smooth and well built ways that are available for communication in Europe, but it must be remembered that European roads often represent the development of as many centuries as those of America represent years.

Europe developed through the building of highways. America constructed railroads as the principal means of communication. Now the construction and use of roads as a means of reducing the cost of transportation, at least between points within a reasonable distance, is evident. But the methods that were the vogue with animals are no longer practical. Time lost with a horse wagon or truck was accepted as a matter of course because there appeared to be no other form of conveyance, but when a motor vehicle is used the desire is to economize time. This is generally accomplished by overloading without a thought of analyzing the work and learning precisely what could be done or where saving could be made. Naturally, it is necessary to have record of what work is done. Many suppose that making comparison with horse work is sufficient to make judgment, but as a matter of fact such determination is about as uncertain as estimating from one figure or dimension.

The cost of horses, established by absolutely accurate accounting, would give a definite standard from which economy might be secured by careful attention to detail and by good administration. This has been the experience of some concerns that have large transportation departments. But there are numerous factors that must be considered before comparisons can be intelligently made. When these enterprises have changed to motorized equipment, the method in use, with such adaptation as might be considered to be necessary, has been continued.

Shevlin-Carpenter Lumber Co.

DRIVERS DAILY REPORT

Route No.—— Yard—— Date——

Driver——

Helper——

TIME

Out—— A. M. In—— P. M. Net—— Hrs.

METER READINGS

Start——. Finish——. Net—— Miles

SUPPLIES

Gas—— Gal. Oil—— Qts. Grease—— Lbs.

Report of Accident or Car Trouble

Witnesses to Accident

Name——

Address——

Name——

Address——

Shevlin-Carpenter Lumber Company's Driver's Daily Report: Printed Both Sides in Black on Heavy Manila Card, 8.5 Inches Length and 4.5 Inches Width.

In the use of motor equipment the cost of any previous work by any other form of transportation is not a material factor. If there is doubt as to the possibilities a change is not well advised. But when motor vehicles have been bought the main purpose is to use them to the greatest advantage. This being so the time of the driver or crew should be divided. The period from leaving the garage to returning may be termed the service time, and the portion of that period that the vehicle is actually in motion may be termed the working time. Under the most favorable circumstances, unless return loads are carried, not more than half the working time can be regarded as productive time.

Assuming for the purpose of illustration that the

REPORT ALL STOPS OR DELAYS OF FIVE MINUTES OR LONGER.

STOP NO.	TIME	PLACE OF	CAUSE OF

Reverse of Monthly Route Record, Printed in Black, Providing for Comparison of Cost for Any Month of Record with That of the Same Month of the Previous Year.

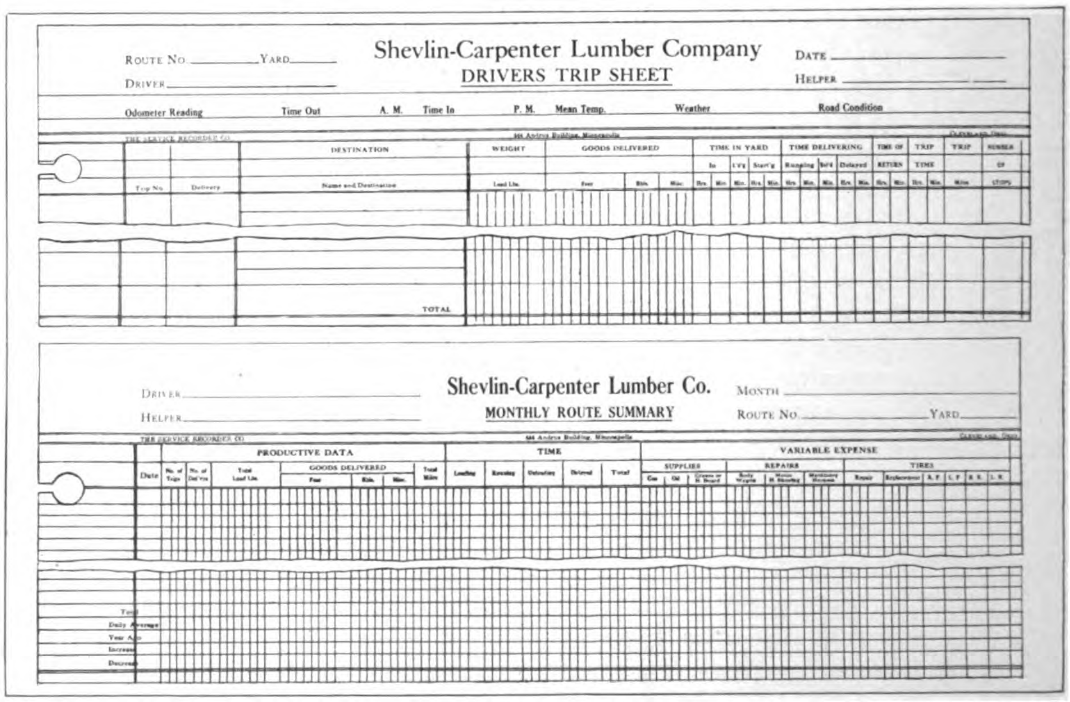
or trucks more or less removed from the store, warehouse, factory, shop, mill or yard, but whatever time is devoted to this form of travel is necessarily unproductive. This time must be included in the working time of the drivers and the period usually has limitations.

The form of record that is best adapted for any system is that which is, so far as possible, mechanical. The reason for this is that it will be uniform in its data and will always be dependable unless an accident should disable the instrument, and such interruption can be insured against by reasonable care in installation. The record should be sufficiently clear that the notes can always be read, and the chart or tape or whatever form the indication may be should be such that it can be conveniently preserved. The cost of records may appear to be considerable, and a system should be as simple as possible and yet supply the data desired. Methods that can be applied to operating cost and garage expense are comparatively easy to create, and these can be depended upon as reliable and satisfactory, but what is most essential is that which will differentiate the service and working time, and from which conclusions can be made that will yield practical economy.

service time of a day is 10 hours, and the working time is seven hours, there is of necessity three hours of idle time, and if the proportion of idle time can be decreased and the working time increased there is an economy that can be measured in money, for it is possible to determine very accurately the expense for a mile, day, week, month or year. The work, however, is much different than where an employee is under observation, as when working at a machine, and where production is accurately known. There are innumerable causes for lost time. It is not practical to enumerate these, but there are a number that have material bearing, and of these loading and unloading are particularly important. Loading can be governed, and it is possible to facilitate unloading, while delays in traffic, from accident, from engine faults or failures, from tire damage, from road conditions, and the disposition of the driver to make the most of his time, cannot be insured against. But it is possible to have a record of the human element involved and to establish responsibility to such an extent that there will be a minimum loss of time, and to direct the work so that the greatest results will be accomplished. This means a closer supervision and an analysis of time of both men and vehicle, and the character of the productiveness will depend largely upon the administration.

The location of the garage with reference to the place of loading is of considerable importance, for distance means unproductive work both going from and returning to the station, and as the number of machines is increased this item assumes greater proportions. There may be economical reasons for keeping the wagons

The Shevlin-Carpenter Lumber Company, Minneapolis, Minn., which uses a number of trucks in lumber haulage, has its vehicles equipped with Service recorders, and from the charts and with the reports of



Shevlin-Carpenter Lumber Company's Records: Upper Form, Driver's Trip Sheet, Printed in Black on Yellow Paper, with Ruling of Red and Blue, with Space for 11 Entries, 8.5 Inches Length and 14 Inches Width, Cut for Loose Leaf Binding; Lower Form, Monthly Route Summary, Printed in Black on Light Lemon Paper, with Ruling of Red and Blue, with Space for 31 Entries, 8.5 Inches Length and 14 Inches Width, Cut for Loose Leaf Binding.

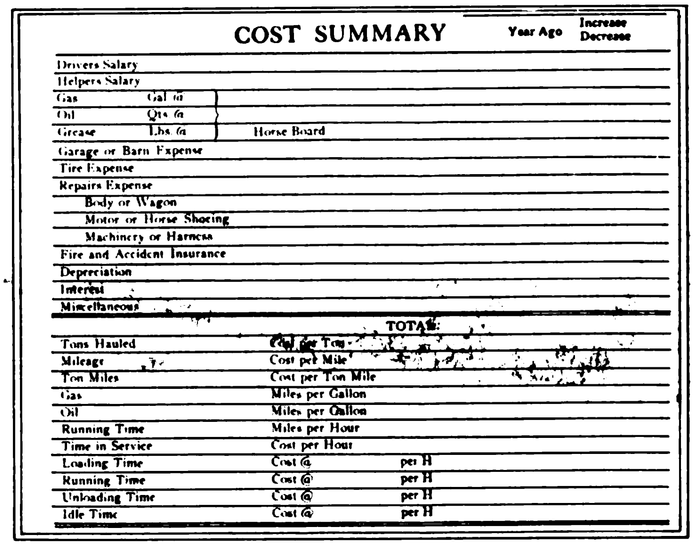
the drivers and the garage records it has at its disposal data that are extremely valuable for comparison, and from which the superintendent makes analyses and directs the administration of the department. The work, as may be assumed, is generally within a reasonable radius of the yards, and most of it is haulage one way, the returns being made without load. The drivers are assigned to routes wherever practical and they drive the same vehicles.

On leaving the garage in the morning, and most of the machines are kept at yard garages, a card known as the "Driver's Daily Report" is begun. On this is entered during the day the number of the route, the number of the yard to which he reports, the date, the names of the driver and helper, the time of leaving and returning and the net number of hours worked (eliminating time for meals, etc.,), the reading of the odometer at start and finish and the net number of miles driven, the quantity of gasoline, oil and grease supplied to the machine, the accidents or vehicle trouble experienced, and the names and addresses of the witnesses, if any, of accidents. The names of two witnesses are obtained. On the reverse of this card is entered a report of all stops or delays of five minutes or more, these being entered in rotation and by number, giving the time of stop and start, the place and the cause. It will be seen that this report will also include the time of loading and unloading each trip, and the times will coincide with the record made by the recorder on the chart. This report is turned in at the office of the garage at the end of the day.

It has no doubt been noted that this card contains many essential facts, but in addition to this the drivers fill what is known as a "Drivers' Trip Sheet", which gives the number of the route, the yard number, the date, and names of the driver and helper, the odometer reading, the time out of the garage in the morning, the time of return, the mean temperature, the weather and the road conditions. On this is also entered, for each trip, the trip number, the nature of delivery, the name of the person purchasing and where the load is to be delivered, the weight of the load in pounds, the goods delivered in feet, barrels and miscellaneous; the time of the vehicle in the yard in hours and minutes, the number of minutes loading and the time of starting the trip; the hours and minutes "running", the minutes making delivery and the hours and minutes delayed; the time of return, the time of the trip in hours and minutes, the mileage of the trip and the number of stops. The sheet has space for 11 entries and it is cut for loose leaf binding.

The "Monthly Route Summary" is a very comprehensive record. This is made up each day and shows the month, route and yard number, names of the driver and helper. Each daily entry is made under the following headings in columns under the general designation of "Productive Data": Date, number of trips, number of deliveries, total load carried in pounds, goods delivered in feet, barrels and miscellaneous and the total mileage. Under the heading of "Time" is shown the total time loading, running, unloading, delays and total. The "Variable Expense" is divided into "Supplies", "Repairs" and "Tires", and under "Supplies" is entered the cost of gasoline, oil, grease or horse board; under "Repairs" is entered body or wagon, motor or horse shoeing and machinery or harness; under "Tires" is entered the cost of repair, replacement and the wheel location, these being designated as right forward, left forward, right rear or left rear. When this sheet is totalled the daily average for each column is found and below it is entered the average for a year ago, and the increase or decrease.

On the reverse of this sheet is entered the cost summary, and this includes the driver's salary, helper's salary, gallons of gasoline and the price, gallons of oil and the price, pounds of grease and the price, horse board, garage or barn expense, repair expense divided into body of wagon, motor or horse shoeing, machinery or harness; fire and accident insurance, depreciation, interest and miscellaneous, these being itemized. Against this column are set the items for the


COST SUMMARY — Year Ago — Increase / Decrease

Drivers Salary			
Helpers Salary			
Gas	Gal @		
Oil	Qts @		
Grease	Lbs @	Horse Board	
Garage or Barn Expense			
Tire Expense			
Repairs Expense			
Body or Wagon			
Motor or Horse Shoeing			
Machinery or Harness			
Fire and Accident Insurance			
Depreciation			
Interest			
Miscellaneous			
		TOTAL:	
Tons Hauled	Cost per Ton		
Mileage	Cost per Mile		
Ton Miles	Cost per Ton Mile		
Gas	Miles per Gallon		
Oil	Miles per Gallon		
Running Time	Miles per Hour		
Time in Service	Cost per Hour		
Loading Time	Cost @	per H	
Running Time	Cost @	per H	
Unloading Time	Cost @	per H	
Idle Time	Cost @	per H	

Reverse of Monthly Route Record, Printed in Black, Providing for Comparison of Cost for Any Month of Record with That of the Same Month of the Previous Year.

same month of the previous year, and the increase or decrease shown. Two columns are totalled and the increase or decrease in the yearly comparison indicated.

On the same form, below, is entered the tonnage hauled and the cost per ton, the mileage and the cost per mile, the ton-miles and the cost per ton-mile, and total gasoline consumed and the miles per gallon, the oil used and the miles per gallon, the total running time and the average miles per hour, the time in service and the cost per hour, the loading time and the cost per hour, the running time and the cost per hour, the unloading time and the cost per hour, and the idle time and the cost per hour. As with the first tabulation, the items are compared with those of the previous year and the increase or decrease shown.

In this summary results are shown in an exceedingly simple manner. The comparison of the cost is obtainable from the driver's report and the trip report for

practically every item save the four fixed charge items, insurance, depreciation, interest and miscellaneous, but included with these usual statements is the service time and its analysis and the cost, and a definite means of comparison.

With these summaries it is possible to make comparison of different vehicles, to make further analysis by the day or for any given period, and to learn just what proportion of the time is used for productive work and the proportion and cost of the idle time.

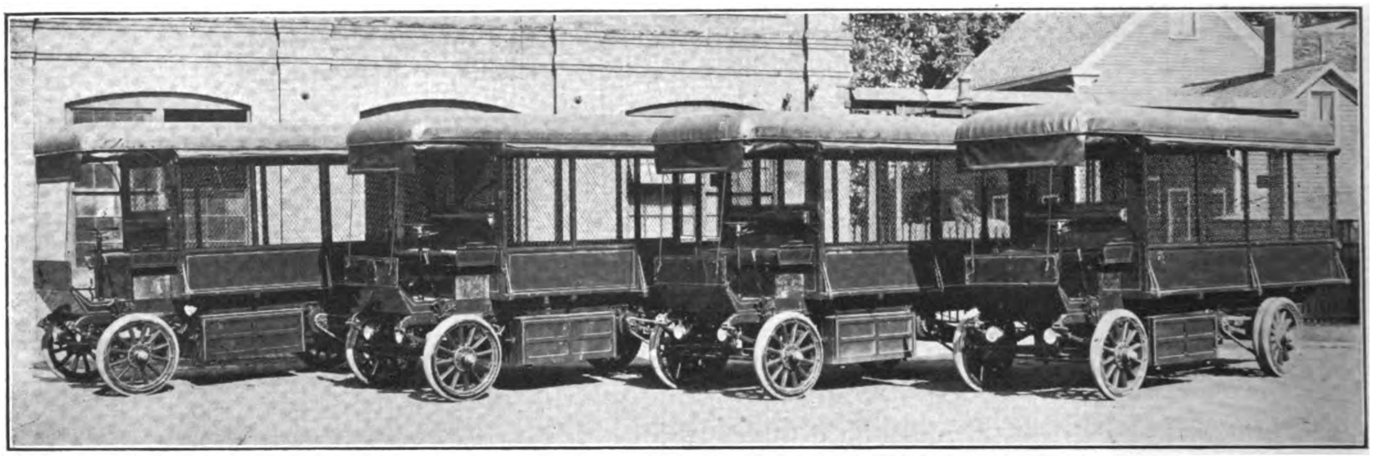
The record is not complicated. Practically everything necessary in connection with its use is shown in the forms that have been reproduced, and examination will demonstrate that these may be adapted to practically any system with the addition of some form of recording instrument that will supply the data relative to the time. It is evident that with a working day of 10 hours the time of a truck and its crew at $12 is two cents a minute. If the truck is in service 10 hours and its working time is six hours and 40 minutes the time is worth three cents a minute. The working time must pay for the idle time. If the working time can be increased the cost of the work is correspondingly decreased, and as there is but little cost, aside from fuel and tire, for this added working time the gain is decidedly important.

CONSTANT SERVICE WAGONS.

New York Edison Company Adds Four Baker Two-Ton Machines to Its Fleet.

The New York Edison Company, which serves the island of Manhattan and the Bronx of New York with electric current for light, power and heating, provides a service that must be continuous, and which requires the maintenance of a part of its transportation equipment so that it will be available practically at all times. The department is extremely well organized and a surprising volume of work is done with the fleet of electric machines that it utilizes, but the majority of the wagons and trucks are used during the day, the remainder being in service for trimming and patrolling. Electric vehicles can be driven constantly, aside from the time necessary for charging the batteries, and with a view of economizing garaging space, which has become a problem of no small proportions, and of minimizing other expenses, the company has made provision for making battery changes which will make the machines available at all times during the day or night by simply exchanging the batteries.

The greater part of the equipment is fitted with side loading battery boxes, although some of the wagons and trucks have boxes that are loaded and unloaded from the bottom. It is probable that these will be eventually changed so that they can all be loaded from the bottom, and to this end the garages have been fitted with pneumatic lifts. These lifts are located where the wagons can be driven over them, being in pits with platforms that are level with the floors. The batteries are taken from the battery rooms, where they are charged, on small hand trucks, and moved from the trucks to the lifts. By these lifts they are raised into the battery boxes of the machines, and when at a sufficient height they are held by automatic catches that retain them until released.



Four Two-Ton Baker Electric Wagons, Equipped with Bottom Loading Battery Boxes, in the Service of the New York Edison Company.

The company originally used lifts that were operated by hand pumps, and which required more time than was desired to raise and lower the batteries, and while these were efficient there was objection to the time required. With lifts operated mechanically the batteries can be quickly lowered or raised and an exchange made in very short time. All of the machines the company is adding to its fleet are equipped with the bottom loading battery boxes, this form of equipment being a feature of construction of the four Baker two-ton electric wagons that were recently added to the department. The company now has nearly 125 vehicles in its transportation department service, most of which are electric, and by exchanging the batteries these may be used practically the 24 hours, and the charging of the spare batteries can be done at any time. The arrangement also minimizes the charging equipment for the garages, as under the usual plan of operation from five to eight hours is necessary for energizing the batteries to the capacity desired.

MOTOR DELIVERY OF BOTTLED GOODS.

Pureoxia Company Minimizes Expense of Distribution in Boston and Suburbs, and Realizes Material Profit from a Limited Public Service at Its Garage.

THE business of the Pureoxia Company, Boston, Mass., is the manufacture and distribution of non-alcoholic beverages, which are bottled and delivered either to dealers or families. The company has been established for a number of years and its plant is located in Back Bay at Whipple and Norway streets. The success of the enterprise depends very largely upon its method of distributing its products, and as the demand increases or diminishes with the variations of temperature it is evident that the greatest volume delivered is during the part of the year when the temperature is high.

The company is well known and its beverages are standard in Boston and suburbs, where daily distribution is made. The plant is of considerable size and it has been equipped with every facility for the production of high quality products, the purity of which is emphasized. The greatest attention is given to sanitation and cleanliness in the plant, the different beverages are carefully bottled, attractively labelled, and are carried in substantial crates. The appearance of the crates and the bottles is regarded as being highly important, and the delivery is made by vehicles that are extremely well kept. The advertising value of the transportation department of the company is unusually large, because this is a means of keeping before the public a quality of production that has been established and is widely known. The company has spent money liberally for publicity and its reputation is a very large asset.

The Pureoxia Company has made no endeavor to extend its business beyond Boston and its immediate suburbs, and a radius of 15 miles from the plant is the longest distance that is traversed in a direct line, but in an area that has a population of more than a million people there are abundant opportunities for increasing sales. And for a business of this character the expense of distribution is proportionately so large that concentration of custom is more profitable than to develop customers at greater distances. That is to say, experience has taught that the more concentrated the given volume of business the more productive it is.

For a number of years the delivery was by horse equipment, but in August, 1911, the first motor wagon was purchased, this being a three-ton Rapid gasoline machine that was used for general delivery in sections that were then served by horse wagons, and to customers who were so far distant that they could not be afforded the service that good business demanded. The wagon was bought at a time when the demand was at its height and for that reason it was worked with a view of relieving the horse equipment, and when this had been accomplished attention was given to the custom that could not be well cared for without working the animals harder than good judgment would permit.

The Five Two-Ton General Vehicle Wagons Used by the Pureoxia Company, Boston, Mass., for General Delivery in That City and Suburbs.

The result of the use of the Rapid wagon was that a two-ton General Vehicle wagon was ordered for route service, and was delivered in December, 1911. The company had not begun motorization without considerable knowledge of the work that could be done, the limitations of the vehicles, the care and attention required, and the changes that were necessary to insure efficient operation. At Norway and Whipple streets was a two-story building in which a public garage was located, the business having been established several years and having a profitable custom. The property was purchased and the garage passed into the possession of the company, and the business was continued. In the garage was kept the Rapid wagon and, when the electric was received it was also stored there, a charging panel being added to the equipment.

The property was acquired for several reasons,

among them being the need for expanding the plant later on and that the limitations of the building then occupied had been reached, that the basement and second floor afforded excellent storage, and it was available for garage use without incurring expense. As the purpose was to conduct the garage and to make it self-sustaining, if possible, the business was maintained separately, and it has not appeared in the bookkeeping as a liability or an asset, but has existence entirely apart. Two two-ton electric wagons were bought early in 1912. These were, with the other electric wagon, used practically for route work. Of course these were assigned to the sections where the horses would be worked very hard, especially in the warm weather, but a great deal of the delivery was done by animal wagons.

With horses routes were in some instances as those covered by the electric wagons, but in some instances the animals were changed at noon, and in others they were worked every other day or five days a week, the use being governed by circumstances and the volume of work. The routes were made up for horses with reference to the load that could be carried. As the wagons took out loads of crates of filled bottles, and usually picked up a crate of empty bottles for every full crate delivered, a load was carried all the time. An empty crate weighs about half what a filled crate will weigh. As the crates and bottles are valuable and as they could be collected when delivery was made, without much loss of time, it will be understood that long mileage meant very hard work for horses, and that from one point of view all of the work done was productive. This explanation is made to emphasize that this work was equivalent to carrying 75 per cent. of the load the entire distance, as against carrying a full load half the distance, which is the usual experience with haulage. Before motor wagons were purchased 11 wagons were in service, and at least an extra horse was required for each pair.

The result of the first full year's work with the Rapid wagon and the three electrics was that two more electrics of the same size and make were purchased and also an Autocar wagon, these being delivered early in 1913. With these the number of horses was decreased, and but one has been purchased this year, and the horses now number six in all. During the summer, when the business was the heaviest, extra horses were hired whenever necessary. This was an annual experience, but the number hired this year was smaller and for a shorter period than ever before, the machines taking care of much of the excess business without overworking their crews.

There is little probability that horses will be used after the coming winter. Several wagons will be added to the equipment and next spring the delivery will be made by motor vehicles. With the present system each wagon covers a route and only orders are taken out. The driver does the loading and the delivery, and collects the empty crates and unloads them on his return. During the period of the year when the most business is done each wagon will carry about 100 crates to a load, and in some instances more, and generally to deliver and collect 100 crates is a day's work. Under some circumstances extra work is required, or special trips are made, but only during the extreme height of the summer business.

The electric wagons are used on route work practically all of the time, but the Rapid wagon is occasionally worked on special haulage aside from the routes. The Autocar wagon is sent over a route that includes widely scattered customers in a number of the suburban towns and cities, and in addition it makes trips to deliver special orders. The mileage of the Rapid wagon will range from 30 to 35 daily, the electrics from 23 to 30, and the Autocar will run up to 90 miles during the busiest season of the year. The average of the machines will be 27 for the electrics, 30 for the Rapid and 65 for the Autocar.

All the machines are kept in the garage, where they are washed, cleaned and polished each day, this work being done by the garage employees. The drivers oil and grease their machines and fill the tanks and make replenishments for the gasoline machines, but the batteries are charged at night by the man having charge of the garage. A spare battery is kept at the branch of the battery maker and this is known to be in good condition. In the event of a battery requiring attention an exchange is made and the battery taken out is immediately restored to its normal efficiency, this being done by experienced men and to the standard of the manufacturer. In this manner the maximum of battery efficiency at minimum expense is assured. The garage is in charge of a foreman at night, who looks after the charging, and he has two men who do the washing and polishing. There is usually but one man on duty during the day.

No repairing is done at the garage. There is no machine tool equipment, and the hand tools are generally those supplied with each machine. A few essentials for the electric machines are kept in stock, but a very good supervision is given by the service department of the manufacturer, and if parts are necessary these can be quickly procured. The Autocar is inspected weekly at the service station of the maker, and attention necessary for the Rapid machine is afforded at the General Motors Truck Company's service station.

When the garage was purchased it was giving service to about 25 customers, and at the end of the first year the books showed that it had paid six per cent. on the investment (the money invested in the garage property), and in addition had taken care of the machines of the company at practically no expense to it. This did not consider the actual value of the property to the company for expansion purposes, nor the probable increase in valuation, for property where this is is rapidly increasing in price.

Because of the reduction of the number of customers of the garage the present year to accommodate the seven machines, it is probable that there will not be as

good a showing financially as when the company owned a less number, but with the expense of the vehicles proportioned there will be a very small expenditure for garaging as compared with what might be expected under the usual conditions. But there has been no charge for administration of the business, this having been assumed by the manager in addition to his other duties. The service given at the garage has proven very attractive to the customers and a much greater volume of business could be done were there greater storage facilities.

The majority of the vehicles kept at the garage are gasoline, and aside from the charging panel no additional equipment has been installed. The drivers report at the garage about 7 each morning and after awaiting until the orders received in the first mail are loaded, they are sent away from 7:30 to 7:45. Some of them are absent the greater part of the day and others return one or more times. When horses were used the men were often delayed until 10 before starting, and they were correspondingly late returning. The routes were covered both winter and summer because of the necessity of working the horses during the period when business was light, and there was practically as much help necessary at all times of the year. With the motor equipment it will be possible to combine routes and withdraw a machine from service whenever this may be deemed practicable, and this will afford an economy that would not be possible with animal vehicles.

The machines are fitted with Jones recorders, and these afford a daily record of the time in service, the mileage, the speed, the number of stops and duration of stops, the actual time driven, the idle time and the time required for loading and for delays. Most of the machines are loaded before being sent to the garage for the night and the bodies are jacked to prevent damage to the springs. As the attention in the morning is confined to oiling, greasing and replenishments of fuel, water and lubricant for the gasoline truck, there is no need of delay. A record is kept of the mileage of each machine, the number of cases taken out and the number of empty cases returned, and this makes possible an estimate of the cost of delivery by case, but this entails an estimate of the cost of vehicle maintenance because of the conduct of the garage as a separate business. A record is kept of the gasoline, oil, grease, repairs and electric current required by the day and month, and for the year. The record of the tires shows the make, size, cost, mileage and adjustments. A third record is that of painting and general repairs, which may be regarded as an annual overhauling expense.

The accounting is simplified, there being nothing required in the records that is not essential. Special forms are not used, books being adapted to meet the requirements, and these may be continued for several years without renewals. When the books are filled they are permanent records and are always available.

The manner in which this company utilizes motor equipment is unusual, but it is an excellent illustration of what can be accomplished by a business man who seeks to improve his distribution methods. It is explained by the company that it is hardly practicable to state just what economy has been accomplished, because the business has been increased somewhat and comparisons are difficult to make when there are so many variable factors, but even if there has been no actual saving of money the delivery has been so much improved that there is a distinct gain in this respect and a decided promotion of the business.

ADEQUATE WARNING SIGNALS.

The owners of motor vehicles have found from experience that their drivers have to deal with people who, from carelessness or ignorance, invite or brave danger. In cities and towns where the traffic is congested and the streets much traversed there is necessity for warning signals that shall be sufficiently clear in tone to be heard above all other noise when sounded. The public can safely assume that the owners of trucks and other vehicles do not demand that their drivers endanger the public. To the contrary they insist that every precaution be taken and care observed. The fault lies largely with those who either do not regard warnings, do not hear them, or do not realize the possibilities of carelessness.

In large cities children play in the streets and are seemingly indifferent to consequences. Perhaps they have confidence in their own judgment to avoid danger and do not judge the speed or the distance, or overrate their own abilities to move quickly. The bulb horn signal may be heard reasonable distances when there are not other sounds, but what is apparently necessary is warning that cannot be misunderstood, such as may be given with a horn that can be operated by the pressure of a finger or the toe, such as a Klaxon.

The supposition may be that a warning signal is obnoxious from the volume of sound made, but the public is rapidly awakening to the fact that there must be a distinct and positive sound made that will be understood by all people alike. Those who do not see or hear well may be careful, but failure to act when danger threatens is a cause that no doubt results in injuries and perhaps fatalities. Public sentiment changes quickly, and in many municipalities where the Klaxon or similar horns were frowned upon the authorities are realizing that they are one of the best safeguards that can be procured and are now insisting that such signals be given.

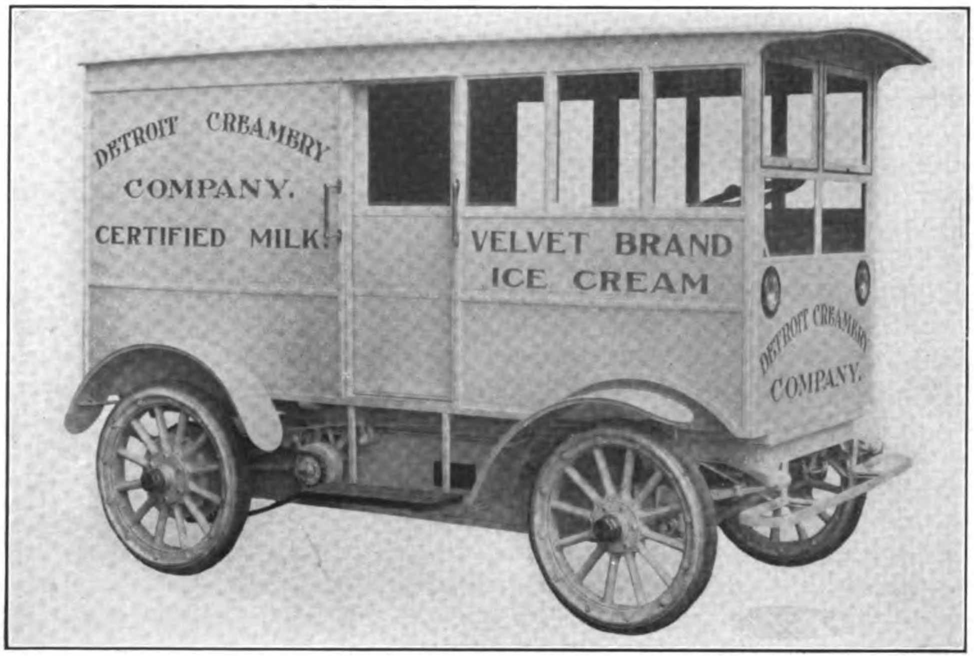
Signals that are adequate are not only a protection for the public, but they protect the owners and the drivers as well, and when these can be given instantly and can be heard plainly, there is no doubt whatever that the only other element to be dealt with is that of sheer carelessness or indifference. This can only be guarded against by placing some responsibility upon the public, but the driver must have the means for making satisfactory signals before this can be done.

SANITARY MILK DELIVERY.

Special Equipment Designed for Service Among Aristocratic Detroiters.

Cleanliness and assurance of quality is one of the best assets of a business man, and with the distribution of dairy products it may be said that appearance of the vehicles is one of the chief recommendations to customers. Sanitation is not a fad, but it is recognized as a necessity with those who would conserve their health. Milk is a standard food, and is consumed in increasing quantities the nation over, and concerns distributing it regard the appearance of their vehicles as exceedingly important.

An example of the endeavor to eliminate animals and to insure purity, as well as serve customers in a wide area, is that of the Detroit, Mich., Creamery Company, which is using a one-ton Detroit electric chassis, equipped with a special body for a route in Grosse Pointe, a suburb 11 miles from the centre of the city, where the majority of the residents possess wealth and demand the best that money can procure. The principal feature of the machine is its appearance.



One-Ton Detroit Electric Wagon with a Special Body That Is Designed for the Sanitary Delivery of Milk.

The body is a box type, with sliding doors at the centres of the sides, the forward half of which is built with a half panel front and two-thirds panel sides, the upper sections being fitted with fixed glass windows. The front of the body is practically a continuation of the dash, and the frame is carried upward with two intersecting members, dividing the space above dash and between the corner posts and the roof into four sections. In the two lower sections are two fixed windows, but the upper have two hinged windows that lift inward and are secured by catches to the roof. The roof extends forward beyond the windows, affording protection against sun and rain. In the upper parts of the doors are windows of the same size as those in the sides. The sides and rear of the body back of the doors are solid panels.

The body is plain, save for a line of molding that extends the length of either side about a third of the height. The material is selected wood, and endurance is insured by the protection of the sills and the side risers with copper sheathing to prevent decay of the wood and to minimize cleaning. The interior is arranged for the purpose of carrying the milk in bottles and to prevent breakage. The wheels are protected by short curved mudguards, and above the forward wheels the body is recessed to provide for clearance when the wagon is loaded. Instead of running boards there is a wide step at either side below the door, carried on heavy brackets. Forward of the chassis frame is a substantial bumper to protect the front of the body. There is little metal work, aside from the hand rails for the doors and the inset dash lamp frames. The interior of the body is lighted by dome lamps. The wagon as it is equipped is a development for practical service and it has appearance that will attract attention wherever seen. It is equally well adapted for all seasons, and affords every quality for protection against storm or dust, and it can be readily cleaned and ventilated. The interior is arranged for carrying milk in bottles or in large containers, and the load can be handled with minimum labor.

The body is painted with white vitrolite, which does not require varnishing, and does not yellow with age. The lettering is with gold leaf pencil varnish. The windows are plate glass.

The wheelbase is 84 inches and tread 58. The forward tires are 32 by three inches and the rear shoes 34 by 3.5 inches. The speed of the machine is 12 miles an hour and the mileage with a single charge of the battery of 60 Edison A-5 cells is 55.

The statement is made by Martin L. Pulcher, general manager of the Federal Motor Truck Company, that Federal machines are used in no less than 120 different classes of business, most of them being standards of industry or commerce, but some have been adapted for purposes that seem novel and unusual. Federal machines are used in Alaska, Cuba, Porto Rico, the Philippines, South America, Australia, India and Portugal, and the list of foreign countries is rapidly growing.

UNITED STATES BUREAU OF MINES RESCUE WAGON.

THE United States Bureau of Mines has stationed at Pittsburg, Penn., a special miners' rescue wagon that is specially fitted with equipment that is desirable or necessary in the event of a mining disaster. This vehicle is regarded as being the most scientifically developed apparatus of its kind in the world, and it is hoped that similar machines will be built and located in mining districts where they can be used for saving life. This wagon is government property and was designed with a view of carrying every form of apparatus that could be used in rescue work, in resuscitation, in affording relief to the injured, and having the speed to respond to a call in very short time.

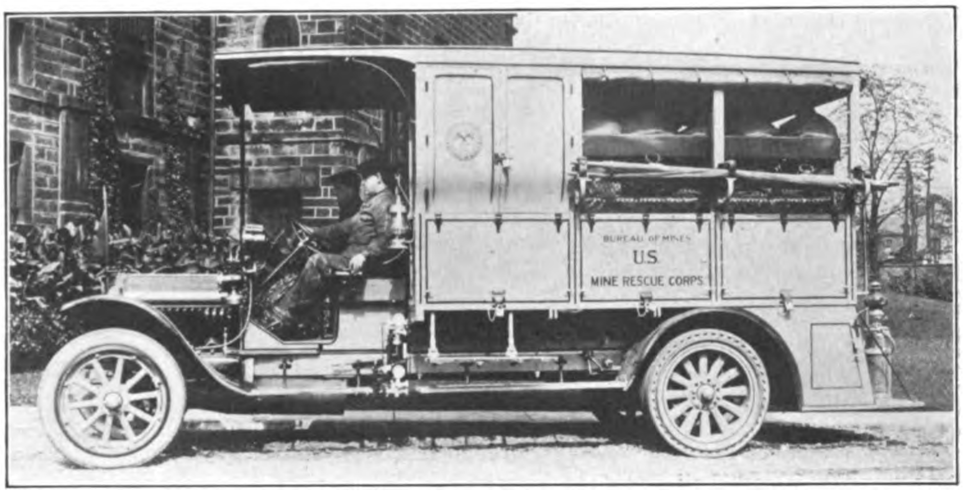
The machine is a White chassis on which is installed a body built to specifications furnished by the government, and with provision for carrying its equipment so that all may be instantly available and no time may be lost whenever there is need. In general appearance the body suggests an ambulance, or police patrol wagon, but this is dispelled when the machine is examined, for every inch of the body is given over to compartments for tools, instruments and apparatus, and these are accessible generally from the exterior, so that the driver or any of the crew may be able to find whatever is required almost instantly, even in the dark.

The machine was shown for the first time at the convention of the American Mine Safety Association, and so great was the approval and so apparent the utility of the apparatus, that it is probable that a number of others will be ordered and stationed in different sections of the country where mining is extensively carried on. For a demonstration a call was made, such as might result from an explosion, during the convention and the vehicle and its equipment shown to those present.

It is proposed by the Bureau of Mines that mine owners establish stations and provide them with similar equipment. The body was built with many compartments for carrying the tools, instruments and utilities which might be used in the event of a mine explosion. Beneath the driver's seat are two Draeger reviving outfits and under the body on a sub-frame are six oxygen tanks, stored transversely of the frame, that they may be readily withdrawn. The oxygen pump is at the left side of the chassis and is driven by the motor. At the back of the seat is a five-foot crowbar and tent poles.

At either side of the body are compartments opened from the outside in which are carried a tent, 22 feet of rope, three miner's picks, three miner's shovels, a four-pound sledge and two axes. Between these are two longitudinal seats with folding lazybacks, protected by a brass rail. Beneath these seats are compartments, and there is another under the rear steps with side and end doors. There are also shallow drawers that contain saws, hose coupling, reducers, spanners and 200 feet of half-inch rope. At the sides of the body in central compartments are a lifeline reel, a telephone system, compasses, bits, braces, chisels, hacksaws and blades, snatch blocks, and suspended outside of the body are two stretchers, fire extinguishers, lanterns, axes, and other tools. On the running boards are two special boxes that contain mine lanterns, and in addition the equipment includes a pump, two first aid boxes, 50 regenerators, two pulmotors, a box of explosives, a full telephone outfit and even a caged bird, the last mentioned being taken into mines to detect poisonous gases.

It will be noted that the machine carries everything that might be used in entering a mine where there is fire or gas, that when necessary a field hospital can be extemporized, and with the equipment a rescue corps can accomplish work that would under ordinary circumstances be almost impossible because of the lack of facilities that experience has taught are absolutely necessary in an emergency.



United States Bureau of Mines Rescue Wagon, a White Chassis, That Is Fitted with Special Equipment.

The Wagenhals Motor Car Company, Detroit, Mich., maker of three-wheel machines especially adapted for delivery purposes, has increased its capital from $100,000 to $500,000, and William Pflum has been elected president, W. G. Wagenhals vice president and treasurer, and Hughes G. Turner secretary. The company is to establish itself in Detroit in a plant that will permit the production of 3000 machines a year.

The Glyco bearing is being marketed by Joseph T. Ryerson & Son, Chicago, and it is claimed that by a bronze or steel reinforcement of skeleton construction the body and flange are greatly strengthened.

LIPPARD-STEWART NEW WORM DRIVEN CHASSIS.

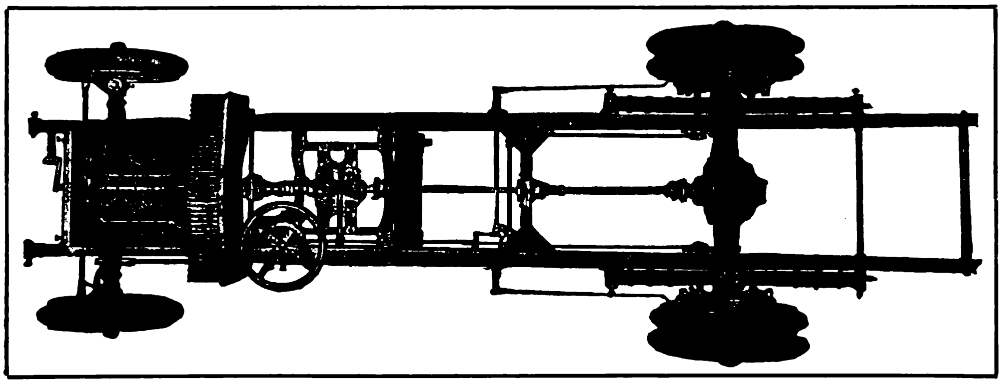
THE Lippard-Stewart Motor Car Company, Buffalo, N. Y., which, since its establishment, has specialized on the production of a 1500-pound delivery wagon chassis, which is marketed with six standard forms of body, has begun the manufacture of a 3000-pound wagon chassis which will be standardized, and which will be produced according to demand. This machine differs from the smaller in that it is driven by a worm and wheel power transmission system, but in general characteristics it follows the design. In the chassis is incorporated such refinements as experience has proven are desirable.

The Continental motor is a four-cylinder, water-cooled, L head type, with cylinder bore of 4.125 inches and stroke of 5.5 inches, which it is claimed will develop 35 horsepower at 1200 revolutions. The cylinders are cast en bloc, provision being made for enclosing the valve stems and springs. The crankshaft is carried on three long main bearings. The engine is controlled by a governor of centrifugal type, connected with a valve in the intake manifold, and operated from the pump shaft. The characteristics of the engine are well known, it being fitted with a float feed carburetor and a high-tension magneto. The cooling system is absolutely reliable. All parts of the motor are easily accessible for inspection or work.

The power plant is mounted in the chassis frame at three points, the forward end being carried on a trunnion, with side arms at the rear extending to the frame side members. The bearing of the forward trunnion is of bronze and a grease cup is provided to insure sufficient and positive lubrication. An Eisemann magneto with fixed spark simplifies the ignition system and eliminates hand control, while to afford a satisfactory fuel the carburetor has separate high and low adjustments, and the gasoline supply may be regulated by a regulator on the dash. The radiator is built with cast aluminum tanks and finned copper tubes, through which the water is circulated by a centrifugal pump. The radiator tube is installed in two groups, which may be quickly removed or replaced by others in the event of damage. The radiator is mounted on spring supports. Radiation is promoted by a circulation of air caused by fan blades attached to the rim of the flywheel. The engine is lubricated by a combination force feed and splash system, the oil being circulated through a system of tubes to the main bearings by two plunger pumps, and to the timing gearcase, the drainage filling the pits into which the big ends of the connecting rods dip. The oil is filtered and is used continuously. The quantity of lubricant in the reservoir is indicated by a sight gauge.

The clutch is a pressed steel cone faced with leather, beneath which springs are installed to insure ease of engagement.

The transmission gearset is a selective type, having three forward speed ratios and reverse. The gears have inch faces and the heavy shafts are mounted on roller bearings. The main driving shaft is in two sections, the rear end of the forward half being carried on a self-adjusting ball bearing mounted on a frame cross member, this construction eliminating all side pressure, and when the chassis is loaded the driving shaft is practically in a straight line. There are three universal joints, one back of the gearset case and one at each end of the rear section of the driving shaft.



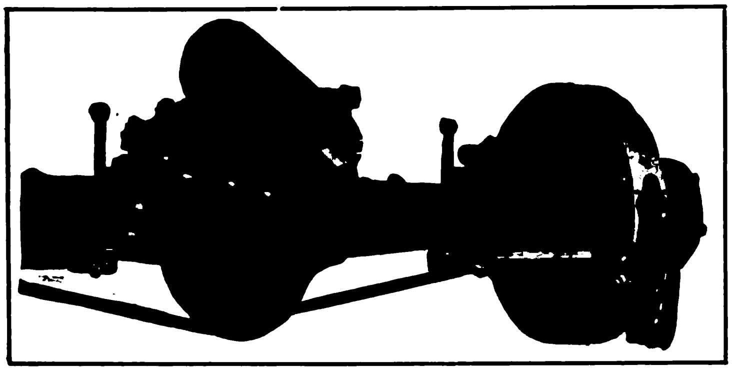
The Plan View of the New Worm Driven Lippard-Stewart 3000-Pound Wagon Chassis.

The rear axle is the Timken-Brown full floating type, the housing being in three sections, the centre containing the differential and the worm shaft and worm wheel, and to this centre the tubular ends are bolted. The housing is strongly ribbed and trussed. The worm shaft is steel and the worm wheel of bronze. Timken roller bearings are used throughout. Lubrication of the worm shaft is by troughs in the housing that carry the oil as it is distributed by the centrifugal movement of the gear wheel. By means of cleaning holes the worm, gear wheel and differential may be washed when necessary. The front axle is an I section steel forging with a solid rectangular centre reinforcement. The wheels and steering knuckles are mounted with Timken bearings. Both sets of brakes operate on the rear wheels, the service brake shoes being of the external contracting type applied through an equalizer, and the emergency brake shoes are expanding. The brake drums are 17 inches diameter and 2.75 inches width.

The drive is left side, the steering gear being of the worm and gear type, the drag link connections with the steering knuckle arms having ball and socket joints, with spring buffers. The hand wheel is 18 inches diameter, with the throttle lever mounted on the steering column.

The wheelbase is either 145 or 158 inches as desired, and bodies of 10 and 12 feet may be installed

without overhang. The load is so distributed that 30 per cent. is carried on the forward wheels and 70 per cent. on the rear wheels. The chassis frame is 6.0625



The Rear Axle Construction of the Lippard-Stewart 3000-Pound Wagon Chassis.

inches width channel section of 4.25 inches depth and .25 inch thickness, and is alloy steel. The forward member is hinged so that the power plant may be readily withdrawn on skids when desired. There are four other cross frame members, that at the rear being a tubular tierod. The frame at the forward end is "necked" to insure short turning radius.

Following the design of the smaller machine the motor is carried forward of the radiator and under a sloping hood, which may be lifted on hinges attached to the dash. The magneto and the carburetor are reached by lifting the hood and the clutch and gearset case are accessible by lifting the floorboards. The clutch can be taken out without removing the motor or the gearset, and the gearset may be dropped without disturbing the clutch. By loosening a winged nut and a clamp the mud pan can be drawn forward and the lower half of the crankcase exposed, and the lower section of the case can be dropped to reach the motor bearings. Careful provision is made for lubrication, grease cups outside the frame lubricating the clutch and brake countershaft, and the springs are fitted with self-lubricating bolts. The gasoline tank capacity is 20 gallons.

The chassis is fitted with a driver's seat and front mudguards, as well as the usual tools and tire repair kit. The company is prepared, however, to supply bodies of standard types.

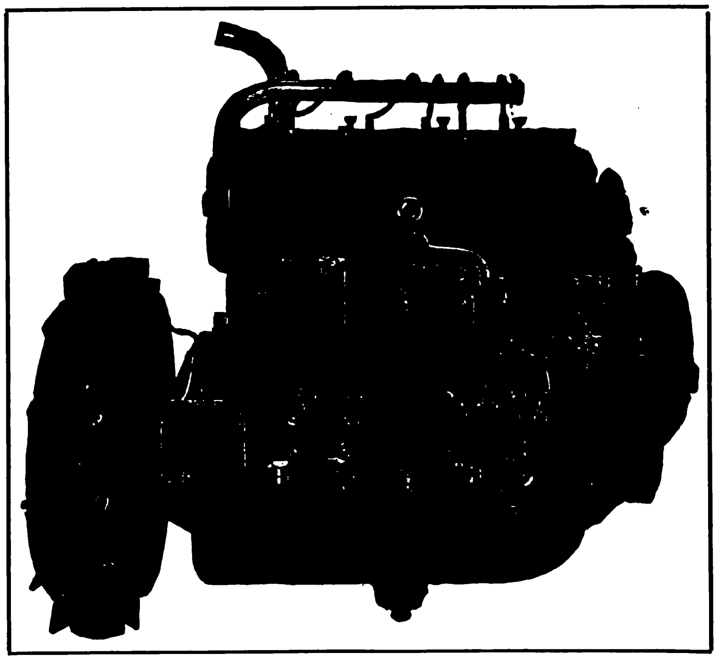
FORTY PER CENT. STOCK DIVIDEND.

Packard Motor Car Company's Capital Increased from $10,000,000 to $16,000,000.

The owners of the common stock of the Packard Motor Car Company who had for four years permitted the earnings of their stock to be applied to the development of the business, received a stock dividend of 40 per cent. at the annual meeting of the company Oct. 16. The stockholders voted to authorize the increase of capital from $10,000,000 to $16,000,000, by issuing $3,000,000 each common and preferred stock, and besides the stock dividend of $2,000,000 in common stock, the remaining $1,000,000 common stock and $3,000,000 preferred stock will be retained in the treasury. The stockholders waived right to the common stock and this will be issued as funds are needed by the company, and the $3,000,000 preferred stock, to which right was also waived, will be retained as a reserve to take up the issue of $3,000,000 five per cent. gold notes that will mature Dec. 1, 1916, or may be devoted to other purposes in the event of need. The statement is made that when an issue of capital stock is authorized considerable time must elapse before the requirements of the Michigan law can be conformed with, and the officials of the company believed it best to have some of the company's stock where it could be available when it would be needed.

The directors elected were: Henry B. Joy, Richard P. Joy, Fred M. Alger, Russell A. Alger, Philip H. McMillan, Truman H. Newberry, all of Detroit, and J. W. Packard of Warren, O. The directors elected the following officers: President, Henry B. Joy; vice presidents, Russell A. Alger and S. D. Waldon; secretary and treasurer, Philip H. McMillan; general manager, Alvan Macauley.

The annual report of the company of Aug. 31 shows that during 1912-1913, 3994 vehicles were built. The receipts during the fiscal year were $18,606,752.34, and including a cash balance of $1,030,519.95, the total was $19,637,266.29. The disbursements were $18,262,-315.17, leaving a cash balance of $1,374,951.12. The assets, including a plant valued at $5,260,950.28, and branch investments of $1,481,893.61, amounted to $17,-339,848.10. The liabilities, including $5,000,000 common and $5,000,000 preferred stock and $3,000,000 outstanding gold notes, and a surplus of $3,006,256.22, showed the same total. The net profit for the year was $2,157,472.40. The company during the fiscal year

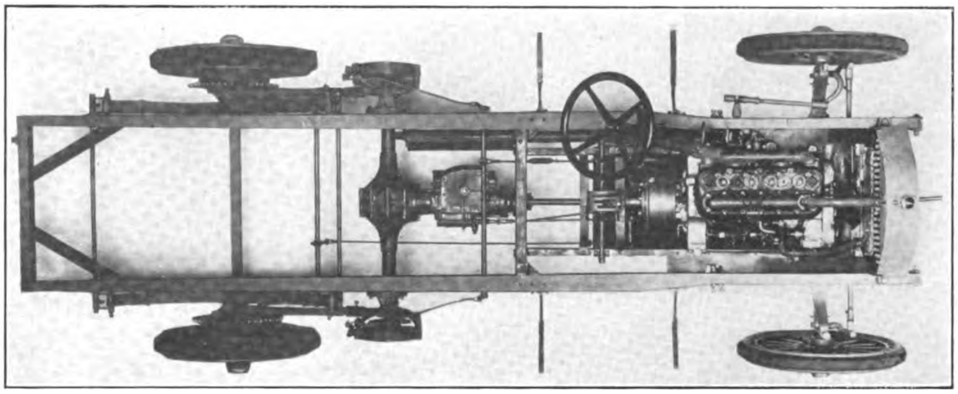


The Right Side of the Motor Used in the Lippard-Stewart 3000-Pound Wagon Chassis.

produced the largest number of vehicles in its history and the prospects were regarded as being particularly promising, both for pleasure vehicles and for trucks.

REPUBLIC 1500 TO 2000-POUND DELIVERY WAGON.

THE Republic motor wagon, of 1500-2000 pounds capacity, built by the Alma Motor Truck Company, Alma, Mich., is specialized by this firm, but one type of chassis being produced. The machine is designed from the standard productions of manufacturers who specialize the building of motor vehicle parts, and it is maintained that the designs, material and workmanship have been proven to be in every way satisfactory and enduring. It is further claimed by the maker that all of the units used in the construction of these machines are from 50 to 100 per cent. oversized, and that some of them are found in vehicles that have twice the rated capacity of the Republic wagons.



Top View of the Stripped Chassis of the Republic Wagon, Which Has a Rated Capacity of 1500-2000 Pounds.

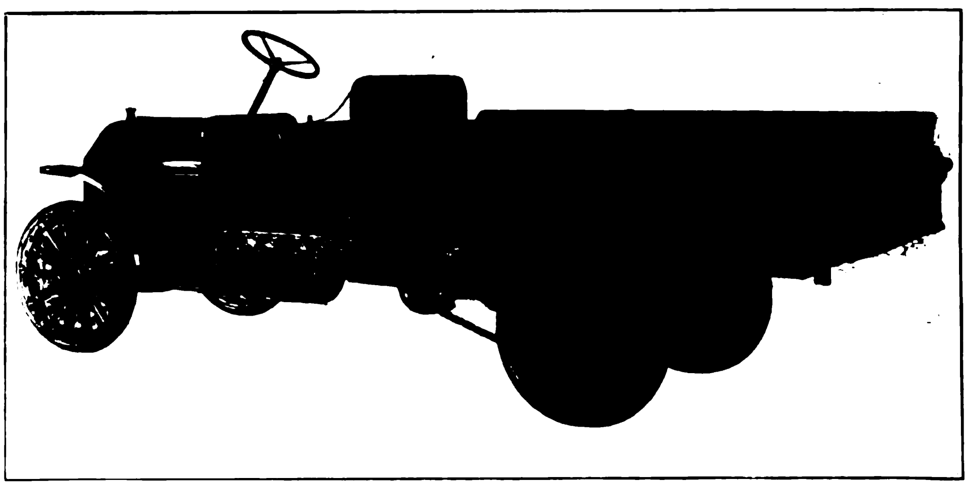
The company purposes to produce approximately 500 machines of this type during the year to come, and it is believed that a vehicle that will be specialized will be better understood and will afford better satisfaction than what might be regarded by some as experimental. In manufacturing, the company claims to have the resources of the best of manufacturers, skilled engineers, splendid facilities and high grade material, and that it is justified in claiming for Republic wagons every requirement that could be sought by a discriminating purchaser.

The motor is a Continental product, being a four-cylinder, water cooled, L head type, with the cylinders cast en bloc, with cylinder bore of 3.75 inches and stroke of 5.25 inches, giving 25 horsepower at conservative rating. The motor is built with the valve mechanism enclosed and it has no exposed working parts. The engine is cooled by a circulation of water through the large cylinder jackets and an ample radiator from a centrifugal pump located at the right side of the motor. A fan that is mounted on an adjustable bracket on the forward end of the engine block is driven by a flat belt from a pulley on the magneto and pump shaft. The motor is lubricated by a combination force feed and splash system, the oil being filtered as it is drawn from the reservoir in the base of the engine crankcase.

The ignition is from an Eisemann high-tension magneto mounted on a bracket at the right side of the motor, and the spark is fixed, there being no hand control lever to regulate the firing of the cylinders. The carburetor is a standard float feed automatic type that is said to give ample mixture at all engine speeds. The motor is suspended in a sub-frame at four points and is protected from the vibratory stresses of road shock and from chassis distortion. The radiator is carried on trunnions that are mounted in supporting cylinders between helical springs, and is protected from strains and distortion that might cause leakage.

The clutch is a Hartford leather-faced cone of large diameter and it is, with the speed changing and emergency brake mechanism, supported on the subframe with the motor, and is free from the effects of chassis stresses. The cone is of large area and it is fitted with a brake to prevent spinning while changing from one speed ratio to another. The driving shaft is carried back from the clutch to the transmission gearset, which is incorporated with the jackshaft, in a straight line, and it is fitted with two universal joints. Great care has been taken to secure perfect alignment of the shaft, which minimizes power consumption and insures against side pressure.

The transmission gearset is a Covert model GI sliding gear construction, that affords three forward



The Republic 1500 to 2000-Pound Wagon Chassis Fitted with a Standard Type of Express Body, with Flareboards.

speeds and reverse, and it is assembled with a jackshaft built by the Russell Motor Axle Company. The jackshaft is suspended from the chassis frame by bell shaped brackets, and these also carry the forward ends of the radius rods, so there is no strain upon the jackshaft or its housing. Hyatt roller bearings are used throughout the jackshaft and the gearset. The drive from the jackshaft to the rear wheel is by detachable link chains.

The chassis frame is of large steel channel section, strongly built and with ample reinforcement. It is carried on semi-elliptic springs forward of 38 inches length and 2.25 inches width, and the rear springs are 46 inches length and 2.25 inches width, the springs being of a high quality of carbon spring steel. The rear springs are mounted with the hangers and shackles outside of the frame, this making for a low loading height and a steady body. The axles are steel drop forgings of ample size and as the chassis is constructed 30 per cent. of the load is carried on the forward wheels and 70 per cent. on the rear axle. The front wheel spindles are 1.75 inches diameter and the rear axle spindles two inches diameter. The wheels are mounted on Bower roller bearings. The wheels are an artillery type, with 34 by 3.5-inch tires forward and four-inch tires rear. Because of the full universal type construction of the radius rods there are no strains at any time upon the rear axle or driving mechanism. The service brake of the contracting band construction operates on 10-inch drums on the ends of the jackshaft, and the emergency brake of the internal expanding type operates within 14-inch drums bolted on the rear wheels.

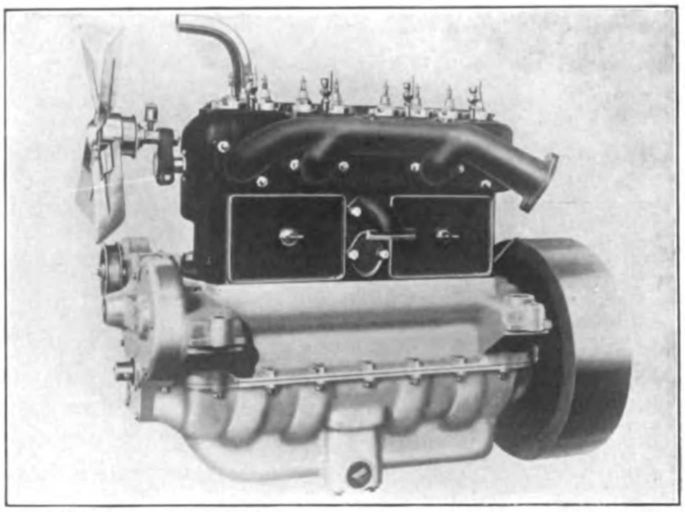
The steering column is at the left side and the control levers are at the right of the driver. The steering wheel is free of levers, the ignition being fixed, and the fuel supply is governed by a foot accelerator on the floorboard, the accelerator being of a construction so graduated that it can be controlled by side instead of downward pressure, and uniform speeds can be maintained over rough roads and paving. The chassis is regularly furnished with wheelbase of 116 inches, and purchaser may have 124-inch wheelbase if specified.

The standard equipment of the machines is stake or flareboard express bodies, either of which is furnished with the chassis, but special bodies are built to the buyer's specifications. The body shop is prepared to produce whatever may be desired by purchasers at reasonable notice. The sale of the Republic machines is directed by the company from its offices at Detroit, but the export office where the foreign business is transacted, is at 17 Battery place, New York City. The company has developed business in South America and the West Indian islands, as well as in other countries, and the prospect for this is said to be very gratifying.

TRUCK HAULED 18-TON LOCOMOTIVE.

The Beaver Engineering & Construction Company is engaged on a big contract at West Brighton, Staten Island, and recently three 18-ton locomotives were delivered at Tompkinsville, S. I., by the Baltimore & Ohio railroad for use on this work. To convey the engines to West Brighton they were loaded on platform trucks that weigh six tons each, and these trucks and the locomotives were hauled over the road by a La France hydraulic truck. The distance was not great, but there were a number of grades which had to be ascended.

From the B. & O. freight yard in Bay street a four per cent. grade was traversed, and in the Richmond turnpike for two blocks a grade from eight to nine per cent. was met with that was two long blocks in length. As the truck started up this hill a priming cock on the engine opened, and in trying to close it the cock was broken off. The truck was worked with three cylinders and drew the load to the top of the hill. Here a repair was made. Beyond this point a grade of 10.5 per cent. was climbed for 800 feet, and after a level stretch of about .75 mile a hill .75 mile length and with a 12 per cent. grade was ascended without difficulty. The destination was about a quarter mile beyond this hill.



Left or Valve Side of the Motor of the Republic 1500 to 2000-Pound Wagon.

The truck hauled the three locomotives on all the grades and seemingly had not at any time reached the limitation of its haulage capacity. The La France truck has been used for a great deal of very heavy transportation work in New York and vicinity and because of its proven capacity it was secured for the moving of the engines.

The Pope & Talbot Company, contractor, of San Francisco, Cal., recently hauled with a Knox-Martin tractor a piece of timber 103 feet length and 28 inches square, weighing between 13 and 14 tons and containing more than 6000 board feet of wood, through the streets of San Francisco and delivered it at the site of the new city hall, where it will be used as a part of a derrick for handling structural steel and other heavy material. The timber was drawn through the streets and turns made without obstructing the heavy traffic.

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Devoted to Motor Driven Business Vehicles of All Classes.

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Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

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FENDER EQUIPPED TRUCKS.

In several cities recently ordinances have been passed requiring owners of service wagons to equip them with fenders, and in every instance the ordinance has not indicated what form of fender would be satisfactory. The burden has been placed on the owner by providing that the fender must be satisfactory to the authority entrusted with the enforcement of the measure. Neither is there a very clear idea of how a fender can be installed that will meet the assumed purpose of the ordinances.

There is the matter of road clearance, which is an entirely different proposition than is met with in a street railroad car, and the 30-degree angle swing of the steering wheels necessitates a construction that will be considerably wider than the hub caps. The fender must have sufficient inclination to lift obstructions, and this implies considerable length when the device must be suspended from the ends of the spring horns, or an extension of the frame, sufficiently forward to permit full swing of the wheels. The fender ought to be collapsible to economize garage space, and to allow use of the machines in limited spaces, but as the fenders are assumed to be open while the vehicles are in use there is no question that in whatever form they are used they will greatly hamper the drivers in traffic.

There may be a worthy purpose in the minds of those who enact such ordinances, but much more satisfactory results could be accomplished by suppressing the speed maniacs who drive passenger cars, even to the extent of jail sentences.

THE PROBLEM OF TRANSPORTATION.

No subject is of greater importance to the business man of today than transportation economy, and there is seemingly a very logical and necessary reason why it should receive the attention of local organizations composed of men who are engaged in industry or commerce. Each community presents a different phase and the conditions are best known to those who have to meet them. Where traffic regulations are considered advisable the boards of trade, chambers of commerce and associations of business men should participate in at least the preliminary investigations, and restrictions should not be adopted until after careful inquiry has determined that the best has been devised. These organizations can, by concerted endeavor, bring about changes that will be decidedly beneficial, and can minimize congestion at docks and railroad terminals, as well as influence improvements by new methods and changed facilities for handling goods. Owners of delivery equipment, heads of shipping departments, haulage contractors, officials of labor organizations, police officials, superintendents of transportation for railroads and steamship lines, freight agents, pier superintendents, traffic managers and others can be consulted, and where these interests are harmonized there is little doubt that a great saving could be made.

LIMITING TRUCK WEIGHT.

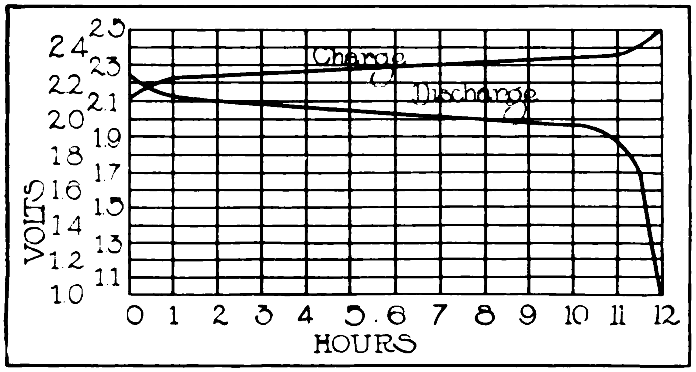
Limiting the weight of trucks has been agitated by elements in differing states and municipalities. Three reasons are urged, the first being the strength of bridges, the second the strength of paving, and the third the congestion in narrow streets. There is evident fear from some, generally the people of the small towns who will benefit from the increase of highway traffic, that they will be required to reinforce bridges that are inadequate for the weights they might be required to support under some circumstances. Such bridges are very few and yet are the basis of the arguments of the legislators. The possible deterioration of paving under the weight of traffic has caused another alarm for some of the city statesmen, and the remedy is believed to be the limitation of the weights of the vehicles and the continuance of the use of the obsolete pavements. The narrow streets, especially those that will not allow more than two wagons or trucks abreast, are regarded as an argument for minimizing the size of bodies. How really logical these arguments are can be judged. Equally satisfactory reasons have been given by those who have opposed the progress of civilization, but the demands of the people have always prevailed. The public today requires economy and efficiency, which can be obtained in greatest measure with large motor vehicles.

ELECTRIC VEHICLE PRACTISE.

The Electrolyte of the Lead-Acid Cell and Variation of Effect with Changes of Temperature and Density---Results Caused by Normal Charging and Discharging and the Ultimate Deterioration of the Plates.

William W. Scott.

STORAGE battery cells, so-called, when utilized for vehicle propulsion, are subjected to the stresses of road shock, and to more or less wear in



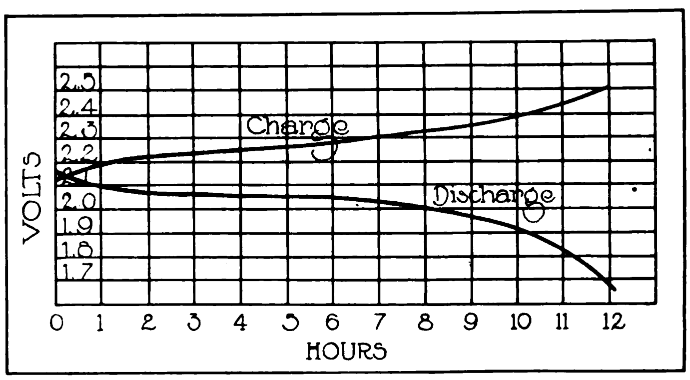
Curves Showing the Charge and Discharge of a Well Constructed Lead-Acid Battery Cell.

handling, and of necessity the construction must be such that they will endure. Vehicle battery cells are practically formed of hard rubber, with walls varying from .0625 to .125 inch thickness, and to minimize weight the volume of electrolyte is generally the smallest volume that can be depended upon to yield the necessary amperage, the quantity depending upon the area of plate surface exposed to the solution. Because the cells are subjected to movement and there will be more or less agitation of the fluid they contain, such cells are sealed, the cover fitting tightly about the element and the joints being filled by a sealing compound, which is applied in a plastic state, being heated and solidifying when cool. The necessity of equalizing the electrolyte and observing the condition with reference to covering the elements in the cells is provided for by one or more holes in the covers, which are closed by tight fitting plugs, in which are vents which allow the escape of gas and yet prevent the electrolyte being thrown from the cells by the motion of the vehicle and in handling the cells.

The size of the cells depends upon the amperage capacity desired, which is governed by the plate area, and plate area is increased by adding plates, for this is regarded as better practise than by increasing the size of the plates. The larger the plate the greater the proportionate weight and the greater the probability of "buckling" or distortion. In practise the small plate in increased numbers is found to afford the better service, and varying the number of plates increases the dimensions of the cell in every way save in length or depth. Obviously the thin plate minimizes weight of element, and there must be a sufficient volume of electrolyte to produce the necessary activity.

There is a limit to the size of the cells because of the space in which they are carried, and there must be a specific number to obtain the necessary voltage. As each cell is roughly rated at two volts, and a maximum capacity is desirable, the battery is determined by the motor voltage. Taking a motor rated at 80 volts, for instance, the capacity of the battery is the difference between the maximum voltage and the voltage of the motor. That is, an 80-volt motor will require that voltage to operate it, and with such a motor the usual battery is 44 cells. If these were of two volts capacity each this would give 88 volts, but as these may be charged to 2.5 volts each this gives a battery capacity of 110 volts, and an operating voltage of 30. The main line voltage, from which the charging current is drawn, may be 110, 115 or 120, and assuming it is 115, the highest voltage that could be given with this would be 2.61 volts. But the line and battery resistance must be considered, and this will cause a reduction of voltage, so that 2.55 would probably be the maximum, save under unusual conditions. Considering the maximum discharge capacity indicated by the fall in voltage from 2.55 to 1.80 volts, as shown by each cell, at which the battery voltage would be 79.2, the total working range of the battery would be 33 volts.

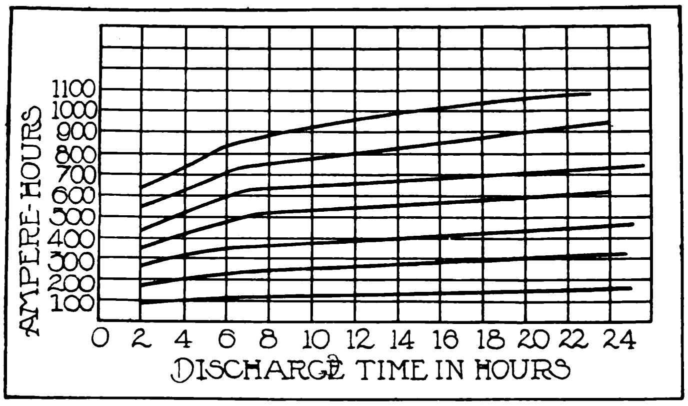
By this is meant that the maximum pressure of the voltage, with the cells connected in series, would be 33 volts. The amperage, however, with the cells connected in series, is that of any one cell, and taking a 225 ampere-hour cell and remembering that the amperage is usually expressed at the eight-hour discharge rate, the cell would be rated at discharging 28 amperes for eight hours, but a far greater amperage could be



Curves of the Charge and Discharge of a Lead-Acid Battery Cell of Standard Type.

discharged for a shorter period. This quality has been previously explained. To obtain this greater amperage or flow of current the cells must be coupled in mul-

tiple. It should be borne in mind that the voltage of a battery is expressed in the combined voltage of the cells in series, but the amperage is expressed in the



The Relation Between the Capacity and Discharge Rate of a Lead-Acid Cell.

capacity of a single cell at the normal discharge rate, which is eight hours.

The owner of a vehicle or even a battery expert has no real interest in the elements that enter into cell design, because there is no reason for concern. The engineers have no doubt produced what has been carefully worked out by theory and developed by experiment until a cell as placed in the market has known quality and capacity, and ought to be regarded as factory perfect when it is delivered. As a standard cell a definite work can be expected from it. Usually the cells are shipped ready for use aside from a freshening charge if several days have elapsed since it was sent from the factory.

But the really important factor in the operation of the battery is the electrolyte. This must be maintained at a standard of quality and the owner, user or the battery man must not only know this, but understand what attention is necessary to obtain efficiency.

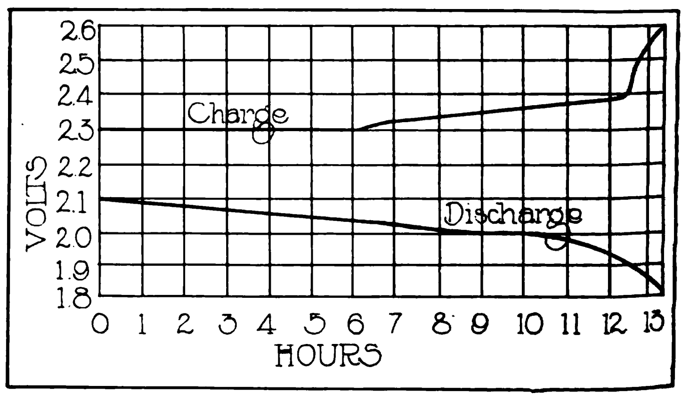
The electrolyte of a lead battery cell is an admixture of sulphuric acid and water perfectly free from all substances and organisms, and this purity cannot be insured in any other manner than distillation. For that reason distilled water is an absolute necessity, and should always be used save in certain emergencies that will be stated. This reservation, however, should not be regarded as a license to use undistilled water. A battery cell is too valuable to risk damage by violation of this rule.

The specific gravity of the electrolyte of cells of batteries used for vehicles is considerably higher than of those used for other purposes. The highest gravity that is found in vehicle battery practise is 1300, which corresponds to 39 per cent. sulphuric acid by weight, and the usual standard of gravity that is advised for battery operation is 1285, or from about 36.5 to 37.5 per cent. acid by weight. Batteries used for other purposes are operated with electrolyte of much less density. It may be stated that the average density is, for such cells, about 1200. That the density of the electrolyte is influenced materially by temperature should be understood, for this factor has decided bearing on the readings and, consequently, on the results.

Primarily an electrolyte is a dilute sulphuric acid, and the density may be shown by the percentage of acid by weight, but this is usually expressed in the specific gravity reading. There are equivalents in percentage for the expressions in specific gravity, which are available for engineers and those who might have need of them, but there is really use for only the latter. These, however, are subject to correction because of temperature variation. But a very simple rule will make it possible for a battery man or even a novice to reach a very accurate determination when using the hydrometer. Because of this variation in density there is necessarily a variable potential, and for that reason charging is recommended at a temperature of 70 degrees Fahrenheit when gravity readings are to be taken, and results are more accurate when this standard is recognized. Engineering records are usually taken at 60 degrees Fahrenheit, but this standard is sometimes departed from. The reason for this is that numerous charts have been worked out and at 60 degrees they can be utilized without correction.

The electrolyte ordinarily used when a vehicle battery is shipped from a factory has a specific gravity of close to or about 1300, when fully charged, and the instruction of the maker is to maintain it at 1285 when fully charged and not to discharge it below 1.8 volts a cell, which is equivalent to a gravity of about 1170. At a specific gravity of 1285 the percentage of acid is 37.5, and at 1170 it is 23.7 or thereabouts, so that there is material change in specific gravity of the electrolyte during charging and discharging. In charging the density increases, and in discharging it decreases.

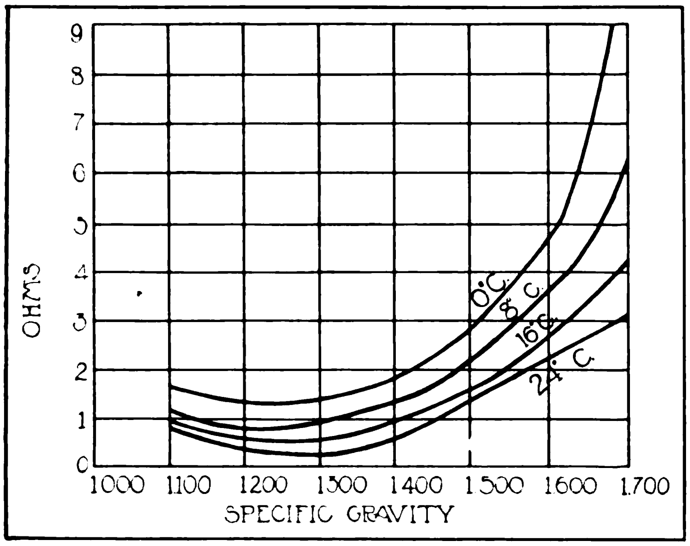
The reason for this change in density has been stated in that chapter that dealt with the general phenomena of secondary cells, but an explanation will not be out of place at this juncture. The sulphion of the acid, that is, the radical that is in solution in the electrolyte, is by the charging released from the lead sulphate formed on the plates when the cell was discharged, and the active material is restored practically to its original form of lead peroxide for the positive plate, and to sponge lead for the negative plate. If the



The Discharge Curve of a Lead-Acid Cell.

charging is at a slow rate and sufficiently prolonged the radical is practically eliminated from the pores of the two plates. As this radical is dissolved it is taken

up by the water and the density is increased. As the cell is discharged the acid radical unites with the lead peroxide and the sponge lead and forms lead sulphate,



Curves Showing the Specific Resistance in Ohms and the Specific Gravity of Electrolyte at Different Densities and Temperatures.

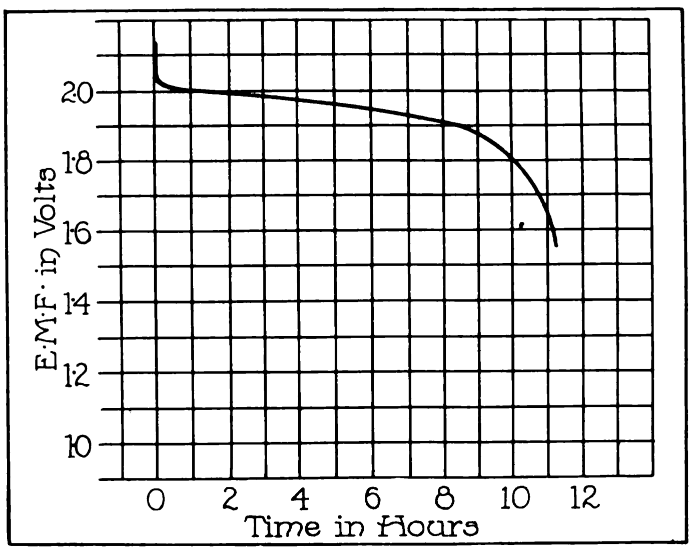
and as this formation takes place the density of the electrolyte is decreased. As has been stated, this formation could continue until the electrodes were reduced to lead and the radical practically reduced from the electrolyte, but to reach this condition, which might be expressed as equilibrium, the lead sulphate would be so heavily deposited that it is doubtful that it could be more than partially removed, and the cell would be materially damaged. This excessive degree of sulphation is to be avoided, and the formation of sulphate prevented below a point where it can be eliminated by charging, by stopping discharge when a voltage of 1.8 a cell is indicated, or when a specific gravity of 1170 is shown.

The electrolyte must be of sulphuric acid made from sulphur. Sulphur that is sold to sulphuric acid manufacturers is refined and rated as chemically pure, and it contains a very small proportion of impurities, which are eliminated by the production of the acid, so that dependence can be placed on this product. Sulphuric acid can be obtained that has a specific gravity of 1845, which is a degree of concentration regarded as a standard by battery engineers. The acid should be diluted with a distilled water that is known to be pure. That is, which has not been exposed to contamination by organisms or mineral substances.

In battery manufactories special equipment is installed for mixing electrolyte, as great care is taken to keep it pure. Where electrolyte is made in such quantities as would be needed in a garage, even of considerable size, the requirements are exceedingly simple and inexpensive, but facilities may be used that can include elaborate apparatus. The statement has been made that the sulphuric acid should be made from sulphur, for acid made from pyrites will often contain particles of iron, and other substances that will seriously affect the electrolyte.

Sulphuric acid manufacturers often prepare a dilute solution that is intended specially for use in storage battery cells, and the claim is made that this has every desirable quality and is ready when required, while it is exactly proportioned. Where a cell is to be entirely filled there is no question of the advantage, but the cost is generally considerably in excess of electrolyte that may be mixed, because there is the weight of the dilute acid as against the weight of the pure acid to be thought of when the cost of transportation is to be paid. Sulphuric acid may be purchased in carboys, and distilled water is procurable in similar containers. These may be kept securely corked and the contents maintained at a known condition of purity.

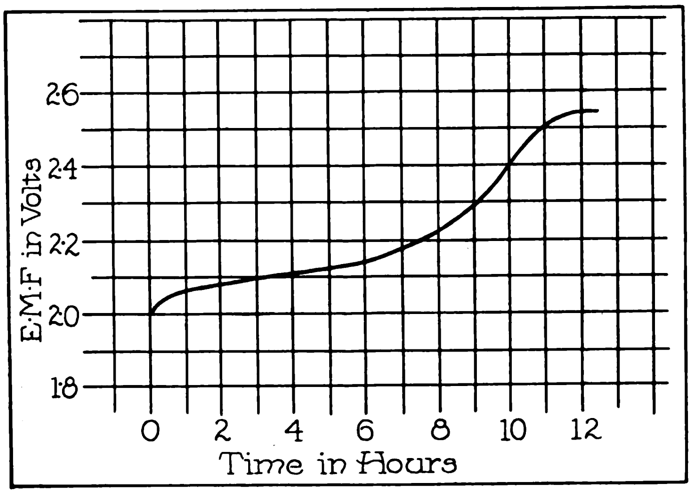
Electrolyte should be mixed in a glass or earthenware jar, crock or vessel, though a lead-lined box may be used if available. The container should be thoroughly cleaned. In this should be placed the distilled water, and then the acid should be added, the acid being poured in slowly and the water and acid mixed by stirring with a glass or rubber rod. A clean wooden stick may be used, but the rod is to be preferred. With the addition of the acid the temperature of the mixture will be considerably increased. The quantity of acid to be mixed with the water will be known by testing the specific gravity, and when the desired degree is reached the electrolyte must be permitted to cool. When cool, however, and the desired temperature is 60 degrees for standard quality, the specific gravity will be found to be higher, and this can be reduced to the reading desired by the addition of distilled water. The electrolyte should be thoroughly mixed before the reading is taken. When the electrolyte when cool is at the desired density it is ready to be added to the cells. This direction, however, applies to electrolyte used for refilling the cells. The specific gravity of the electrolyte for the vehicle battery cell should be aproximately 1285 at 60 degrees



Curve Showing the Fall of the Electromotive Force of a Lead-Acid Cell with the Discharge.

Fahrenheit when the battery is fully charged, and it will then contain about 37.5 per cent. sulphuric acid by weight.

When a battery is received the cells are filled with an electrolyte that has a specific gravity of 1300 or thereabouts. Before a battery is shipped it is given a full charge at a low rate and may be said to have at that time its fullest capacity. The percentage of acid at that reading will be 39. For cells used for power stations the specific gravity at full charge will be from 1190 to 1225, and the percentage of acid will be from 26 to 30.2. This fact is stated to show the greater density of the electrolyte used for the vehicle battery cell. The greater the density of the acid the more active will be the cell, but with the increased density will be a larger degree of sulphation, which accounts for the fact that cells used with stationary batteries will have much longer life than those used in vehicles. The power station cell is drawn upon frequently and yet the charging and discharging is at slower rates as a rule. There is varying resistance of electrolyte, the least being between the specific gravities of 1224 and 1240, and increasing below or above the limitations stated.



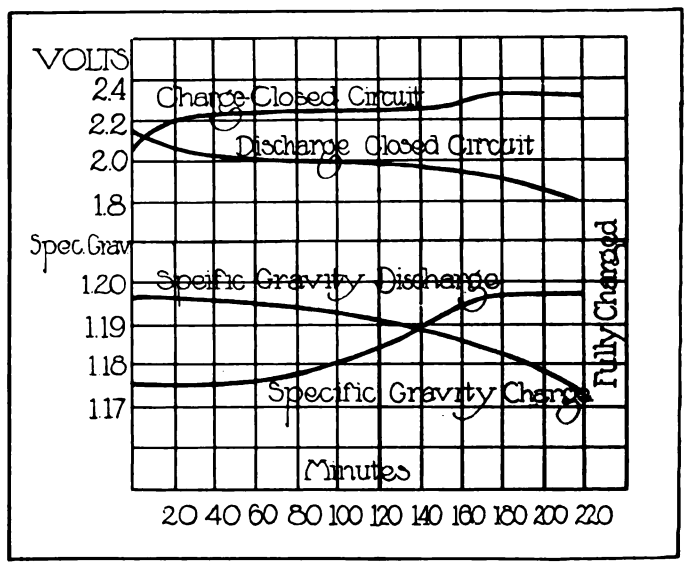
Curve Illustrating the Electromotive Force Required to Charge a Lead-Acid Cell That Gave the Discharge Curve of the Preceding Chart.

Emphasis has been made of the necessity of pure electrolyte. The decomposition of the water of the electrolye in charging causes hydrogen and oxygen to be created and the hydrogen rises to the surface in bubbles and is dissipated. This condition is known as "gassing", and so long as the bubbles arise to the surface and break there is a loss of one of the elements. The recomposition of the water during the period of charging does not restore the hydrogen that has been lost and the electrolyte is constantly concentrating, for the same proportion of acid remains. Then so long as a cell is charged and discharged the density of the electrolyte is increasing, and to maintain it at a standard of efficiency it must be reduced by dilution—by the addition of distilled water. This reduction is known to battery engineers and battery men as equalizing. The process is simply that of adding sufficient water to restore the standard of density.

Because of the addition of water to the cells at such intervals as may be necessary, it is apparent that whatever is carried into the cells with the water must remain there, and impurities which might not be of consequence will, through accumulation, have a very serious influence. Were the water free from all else than organisms these would in time be carbonized or deposited on the plates or separators, and will affect the activity of the cell to a greater or less extent. Matter held in solution in the water might be precipitated and increase the volume of precipitation in the base of the cell. Metallic substances of different natures may be held in solution in the water and sometimes in the acid, and these may include platinum, iron, copper, iron mercury, and all acetates, nitrates and chlorine. The best authorities maintain that there should never be more than one per cent. of iron or any form of nitrogen, ammonia, nitric acid of the total volume of acid in a thoroughly good electrolyte, nor more than .002 per cent. of chlorine.

The platinum, if found at all, will be minute particles held in solution in the acid and introduced with the acid into the electrolyte. High grade sulphuric acid is frequently refined in platinum stills and there is a possibility of particles of the metal being drawn off with the acid. The presence of platinum cannot be well detected unless by test of the acid. which is really a work that only a chemist can determine. The effect of the platinum is to cause discharge of the negative plates, and if an electrolyte is believed to contain platinum it may be tested by placing a quantity in a cell in which are regular plates. With open circuit, should gassing follow for any length of time, the observer can accept the proving of the suspicion.

Iron may be found in acid made from pyrites in sufficient volume to cause damage to the element. It is practical to test the acid to determine whether or not it contains iron, and similar tests may be made for chlorine, nitrates, copper, mercury, arsenic, acetic acid and organic matter. But if care is taken to secure a pure acid and pure water is used, with cleanliness in mixing and using, there is remote probability of impure electrolyte resulting. There. is always a probability of introducing foreign matter into the cells



Curves Illustrating the Variation of Specific Gravity and Voltage of a Lead-Acid Cell During the Charging.

with the water unless special care is taken to keep the cells clean, and those working on cells should be sure that they are free from any accumulations before opening the vents.

The battery cells are usually assembled in crates or trays, these assemblies generally being of such size that they may be conveniently handled, and connectors are often carried from the cells to terminals on the crates that the groups may be coupled, these being so connected with the controller that the groups may be used in combinations. The crates are carried in battery boxes that are intended to afford protection from water, dust and the like. The battery boxes are often ventilated to permit the escape of gas. In rare instances are the cells so carried that there will be no accumulation upon the tops of the cells. Frequently the terminals are given a coating of vaseline to prevent corrosion, and if electrolyte is thrown from the cells in small quantities it will remain on the covers, for should the water evaporate the acid will remain. These conditions are conducive to the retention of dust should it enter the battery box, and because of this possibility the necessity of cleaning the tops of the cells before removing the vent plugs for any purpose is emphasized.

It is evident that when impurities have entered the cells it is impossible to remove them save by removing the elements and renewing the electrolyte, and as this requires time and involves labor, as well as some expense, the advisability of care is desirable from the viewpoint of economy as well as from that of maintenance of capacity and endurance. There are those who may believe that any water that is "soft", such as rain water, may be used, but there is no assurance that such water is free from organisms or particles of iron, and water, unless distilled, may contain carbonates or other elements that may more or less affect the cells.

The effect of the electrolyte at its highest density is to carbonize the vegetable organisms that are in a cell, and while this is a danger of no serious importance, the presence of carbon is undesirable. Water from pipes always contains iron in some form, and iron will affect the plates to a surprising degree. When platinum, which may be found in acid, and iron, which may be found in acid or water, are introduced into a cell the metallic particles will attach themselves to the plates and will cause galvanic action that will continue without interruption, and as this action is a short circuit the result is not only that of discharging the plates, when charged, but will cause deterioration of the sponge lead and the lead peroxide. This condition is known to manufacturers and battery men as local action. There is assurance with cleanliness that the possibility of foreign matter being carried into the cell is reduced to the minimum, and with the use of pure acid and distilled water the electrolyte will be maintained at what may be regarded as the condition that will give reasonable and satisfactory efficiency with any lead battery.

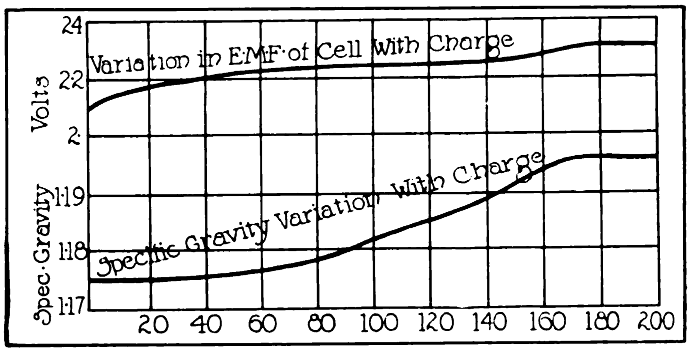
(To Be Continued.)

LORD & TAYLOR BUY ELECTRICS.

Leading New York Department Store Orders 36 Machines for Direct Delivery.

Lord & Taylor, a firm conducting a New York City department store that is known throughout America as one of the most thoroughly dependable of concerns, and has a reputation for distributing the highest quality goods, does a very large business in the metropolis and vicinity. After very careful investigation of delivery equipment, with a view of economizing in its transportation and affording its customers the service that is believed to be essential, the firm has decided to practically transform its vehicles from animal drawn to motor driven, and to this end has ordered 36 1000-pound wagons from the General Vehicle Company, these to be delivered previous to the holidays.

The company purposes to have the machines so that it may use them when the demands upon it are the largest, and the requirements most exacting. Provision is being made for the garaging of the vehicles,



Increase of Electromotive Force in a Lead-Acid Cell During the Charging.

and when they shall be delivered practically little will remain to be done.

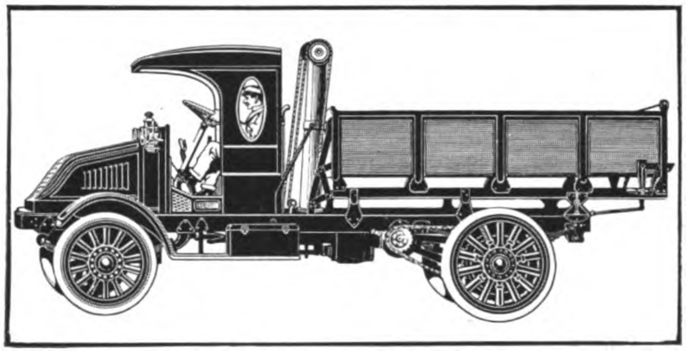
The purchase of these vehicles followed the orders of B. Altman & Co., and McCutchen & Co., for General Vehicle equipment. B. Altman & Co. was the first firm in America, if not in the world, to use electric wagons, its first purchase being made early in 1898, so that it has had more than 15 years' experience with these machines, and at least one of the six small wagons bought at that time is still serviceable. These were 500-pound vehicles, built by the Riker Electric Vehicle Company, and though comparatively light for delivery work they endured remarkably, considering the crudity of their construction and the quality of the materials used.

Lord & Taylor and McCutchen & Co., in the purchases recently made, have secured the latest productions of the General Vehicle Company, the utility of which has been demonstrated by the long experience of other firms.

J. H. Mack has been appointed supervisor of the stations of the Autocar Company in New England with headquarters in Boston.

KELLY TRUCK POWER DUMP EQUIPMENT.

THE Kelly-Springfield Motor Truck Company, Springfield, O., is now fitting the three-ton truck chassis with a power dumping mechanism, which is so



The Power Dumping Body Equipment That Is Now Standard for Kelly Trucks.

constructed that one man can handle machine and unload it with practically no loss of time and with comparatively little effort. The purpose was to simplify the unloading, so that the trucks can be handled by one man on practically all jobs on which they can be worked.

The hoist is built by the Wood Hydraulic Hoist Company of St. Paul, Minn., and it is operated by pumping oil into and from an upright cylinder carried in the centre of the chassis frame behind the driver's seat. The body fittings and the power transmission by which the hoist is driven are the products of the Kelly company's engineers. The hoist itself consists of a long steel cylinder on a base bolted to a frame on the chassis, and in this cylinder is a long trunk piston that is fitted with two piston rings. The piston carries a two-inch diameter rod that extends through the upper or head plate of the cylinder, and this carries a cross arm on which two steel grooved pulleys are mounted. The forward ends of two lengths of steel wire cable are attached to an equalizer, which insures equal strain on each cable, and the rear ends are fastened to the lifting arms attached to the steel body.

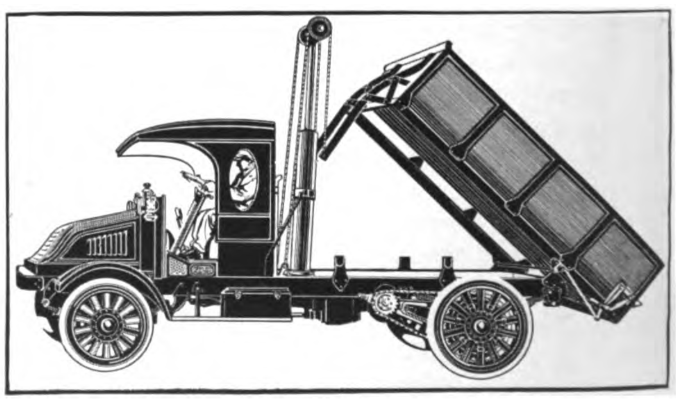
At the base of the cylinder is fitted a gear driven pump, which is operated by chains and sprockets from an extension of the countershaft of the transmission gearset. The speed of the pump is three times that of the engine, this reduction being made so that the engine need not be raced in operating the hoist, and 300 revolutions of the engine will lift the body and a three-ton load and lower it, the operation requiring about one minute. The power of the chassis motor is used, and when the hoist is to be started this is done by the driver disengaging the clutch, as though he were about to shift the speed changing lever. When the countershaft of the gearset has been brought to a standstill a lever at the driver's right is moved and the power connection is made. The lever is located on top of the driver's seat and is out of the way and is convenient when operated.

The engagement of the gear carried on the extension of the gearset countershaft is locked in the same manner as are the sliding bars of the conventional sliding gearset, by spring plungers. These parts are interchangeable with the locks used in the gearset. Because of this positive lock the driver can leave his seat with the hoist in operation until the load has been discharged. After the hoist has been started the driver may leave the machine, walk back and open the tail gate, walk forward to the back of the seat at the right side of the truck, where there is a hand lever that controls the action of the hoist. By pushing this lever from him the hoist will lift the body and by pulling it toward him the hoist will lower the body, and when vertical the hoist is in neutral. When the body is lowered the driver can seat himself at the steering wheel, disengage the clutch, pull the hoist lever to neutral and start the truck. One advantage of the hoist is that no part is in operation save when the load is being discharged. The entire installation is sturdily built and should endure for a long period of time.

Manager Burns of the New Haven, Conn., station of the Standard Oil Company, is authority for the statement that the three-ton White tank truck in the service of that concern is serving as many customers as could be supplied by three and sometimes four two-horse teams and tank wagons. The machine has never been out of service or stalled on the road and it has been driven 5000 miles or more.

A motor omnibus company has been organized to give public passenger service between Cardington and Marion, O., and will operate three machines on 20-minute time.

W. J. McDowell, who has been connected with the Chicago, Ill., office of the General Vehicle Company as salesman, and who had been with that company for three years, has joined the forces of the General Mo-



The New Kelly Truck Power Dumping Body at Its Extreme Elevation.

tors Truck Company at Chicago as salesman for electric vehicles. Mr. McDowell is regarded as having unusual qualifications for selling electric equipment.

Municipal Service Equipment

WHY SHOULD CITIES MOTORIZE?

Knox Automobile Company Official Cites Nine Distinct Advantages Over Horses.

According to Charles F. Barrett, advertising manager of the Knox Automobile Company, Springfield, Mass., maker of Knox fire fighting equipment, there are at least nine distinct advantages of the motor system over the horse method. The list has been compiled from the experience of fire chiefs throughout the country, who give them as follows, in the order of their importance: The saving of time in responding to alarms, larger radius of effective action, ability to get back to quarters more promptly and to get ready for another alarm, ability to carry a more complete equipment and larger complement of men, lower upkeep cost, all the men carried available for fire fighting purposes, saving in fire house investment and upkeep cost, pleasanter and more sanitary quarters for the men, and more time for practise and drill.

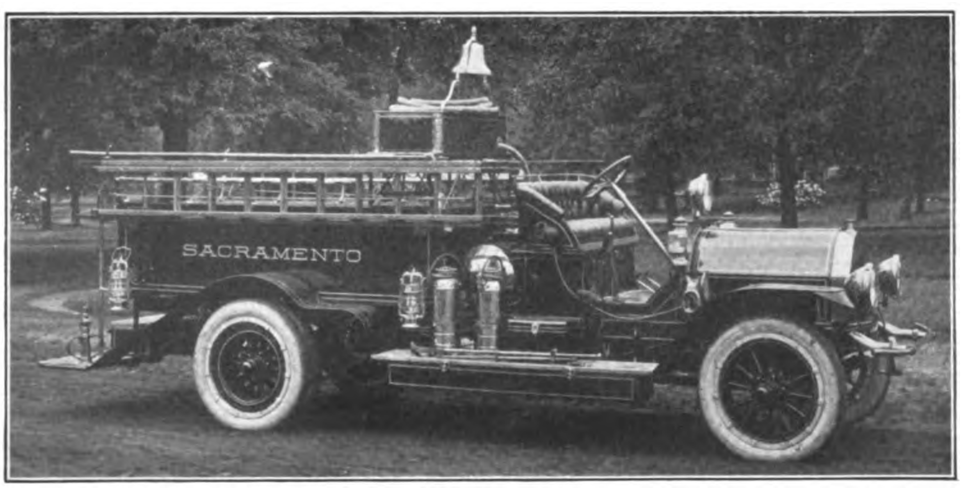
The fire department in Springfield, Mass., which was one of the first cities in the country to adopt motor fire apparatus, now has 30 pieces in service. The officials have kept a very careful account of the cost of both its horse and motor equipment. They find that the latter has saved $8000 this year over last year's budget, although the actual saving was considerably in excess of this amount, as part of it was added to the regular annual appropriation for the purchase of more equipment and the erection of a new fire station.

Respecting the actual saving in fire loss effected by this splendid equipment, the city finds that its fire department answered 829 alarms in 1912, as against 498 in 1907, but in spite of this increase in the number of alarms, the total loss was only $166,000 in 1912, as against $535,000 in 1907. In the latter year the city only had three motor driven machines, so that the greater efficiency due to the addition of more cars is made clearly apparent.

The actual upkeep cost for a two-horse vehicle has been found to average about $524 a year, answering an average of 125 alarms; whereas, the motor vehicle answers an average of 140 alarms at a cost of $181. Five Knox gasoline cars, which bear the brunt of some of the hardest work in the department, average only $34 a year upkeep cost.

Another interesting opinion of the value of motor driven fire apparatus is afforded by the recent report of John H. Dailey, director of the department of public safety in Pittsburg, Penn. He estimates that if his equipment were completely motorized it could maintain a larger force of firemen with the same appropriation than is now possible for the department with horse drawn apparatus. Furthermore, on account of the wider radius of effective action of motor equipment, he believes each company could serve a larger territory, thus making it possible to dispose of some of the stations and concentrate the companies to better advantage.

In the smaller towns and cities the motor fire vehicle has made possible the protection of a very much larger district, so that all taxpayers become interested and are willing to contribute toward the cost of such apparatus. It is pointed out that if such a community purchased, for instance, a combination hose and chemical wagon, it would have a machine capable of giving exceptionally good fire protection for a large district at such a low upkeep cost that the car would pay for itself in a few years on this saving alone. It



Latest Type of Knox Combination Wagon, Recently Installed in Sacramento, Cal.

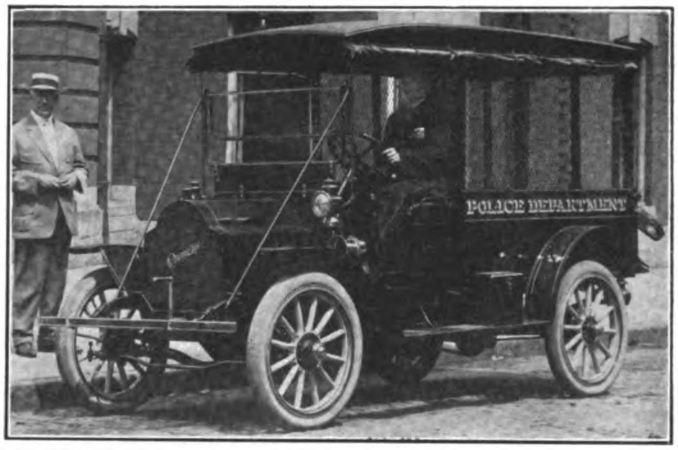
should be remembered, as well, that during the long inactive periods of such a piece of apparatus, it would be costing the community little or nothing, its upkeep cost being approximately in direct proportion to the number of fires.

In view of the advantages to which attention has been directed, it is by no means surprising that cities throughout the country are rapidly installing vehicles of this type. An accompanying illustration shows the latest Knox machine, equipped with electric lighting and all the most modern equipment, recently delivered to the department in Sacramento, Cal. Several machines of this make are doing effective work on the Pacific Coast.

SAVING MONEY FOR THE CITY.

Detroit Police Department Purchases Commerce Car in Interests of Economy.

Those who claim to have given the subject some little study are convinced that one reason why fewer



Commerce 1000-Pound Chassis Fitted with Police Patrol Body for Department in Detroit.

high grade pleasure automobiles are to be found in the second hand market than formerly was the case is due to the fact that many owners of such cars have adopted the plan of purchasing a medium priced machine for everyday use, so to speak. In other words, instead of utilizing the high powered car for running back and forth from the home to the office and about town, this machine is reserved for the more formal occasions and its place in the errand field is taken by a smaller vehicle of less first cost.

The police department in Detroit has a number of patrol wagons which cost the city in the neighborhood of $5000 each. Until recently it was the custom of the precinct officials to send these machines to headquarters twice daily with the reports and any property that might have been taken from prisoners upon arrest. This mileage, when added to that covered in making arrests, brought the total for 1911 to 80,000, and for 1912 to 115,000.

The attention of the police commissioner was called to this matter one day when a policeman stepped from one of these $5000 automobile patrols into his office for a pad of report blanks for a precinct station some distance out. The patrol carried its usual equipment, driver and two officers. The commissioner also took into consideration the fact that when the big car was thus engaged it was absent from duty at the precinct station for which it had been purchased.

The result of this incident was a reorganization of the police patrol system. A 1000-pound Commerce, made by the Commerce Motor Car Company, Detroit, was selected for the errand work. This small car, which is presented in an accompanying illustration, is manned by one policeman, who acts as driver, and it is maintained that it will be but a short time before it will have saved its price, in reduced wear and tear on the larger machines, and in time wasted by salaried patrolmen. The example is one which should prove of interest to other cities, and, indeed, it already has been made the subject of many inquiries to the police commissioner and the Commerce Motor Car Company for particulars.

SPEED OF MOTOR APPARATUS.

Firemen's Herald Expresses Itself Editorially upon an Interesting Subject.

One of the problems which municipal authorities are called upon to face very shortly after the introduction of motor fire apparatus is that of speed. The question is one which has arisen from unexpected quarters just as the fire commission has felt that it had acquired a vehicle which would reduce fire loss largely because of its speed. The Fireman's Herald, a publication devoted to fire department interests, has been requested by a correspondent to voice its sentiments upon this matter, which it does as follows:

> Our opinion is that the highest measure of safety can only be attained through the careful selection and adequate training of fire chauffeurs. The competent man will know when 10 miles an hour is dangerous and 30 an hour reasonably safe. The incompetent man will endanger the lives of everybody on the fire car and on the street, no matter how slowly the car is being driven.
>
> To say arbitrarily that motor apparatus may under no circumstances move at a higher speed than one much less than its maximum, is to rob the automobile of one of its greatest usefulnesses in the fire service. To have an incompetent man at the wheel is a crime.

EXIT THE LAST HORSE.

Fire Department in Youngstown, O., Is Now Completely Motorized.

Youngstown, O., enjoys a unique distinction in the Middle West. It now has an absolutely horseless fire department. The last team in the service was sold Aug. 30, to a liveryman. Harvey Leedy, the driver, made a last exhibition run on the day of sale, but for some time the horses had appeared out of place, being the only pair to answer alarms in any part of the city.

There was a time when the lone Webb pumping engine was the novelty of the department, but its per-

formance was so successful that it was soon called upon to share this novelty with others. Youngstown has 11 stations. One after another was motorized, until the horses at No. 4 in Falls avenue were left to demonstrate the effectiveness of the newer type of apparatus. Station No. 4 now has a Knox machine.

NEWS FROM VARIOUS CITIES.

Decides upon American-La France—After some little discussion of the various propositions laid before it, the fire department in Maynard, Mass., has decided to install an American-La France combination chemical engine and hose wagon, made by the American-La France Fire Engine Company, Elmira, N. Y.

Purchase Seagrave Combinations—The fire department in Freeport, Ill., has placed in service the first of three Seagrave motor combination hose and chemical wagons, made by the Seagrave Company, Columbus, O. The fire officials in Paco, Wash., have contracted for an 80 horsepower combination wagon of the same make.

Want Reduced Insurance Rates—The town council of Kearny, N. J., has decided to defer action concerning the purchase of an automobile fire engine, until it can be learned definitely what reduction will be made in existing fire insurance rates. At present the council favors the proposition, and the chief is strongly urging immediate action.

Garford Trucks in Highway Construction—After conducting a series of tests during the past year to determine the relative economy and efficiency of motor trucks and horse drawn vehicles, the Eastern Asphalt Company, New York City, has added to its equipment, two six-ton Garford trucks, made by the Garford Company, Elyria, O. These machines will be utilized in transporting asphalt from the mixing plant to the various paving jobs about the city, for which the concern has the contracts. Special dumping bodies, designed for quick unloading, have been fitted.

In the Market—The following cities are contemplating the purchase of motor driven fire apparatus: Rochester, N. Y.; Fond du Lac, Wis.; Montgomery, Ala.; Provo, Utah; Albuquerque, N. M.; Watsonville, Cal.; El Paso, Tex.; Sioux City, Ia.; Philadelphia, Penn.; Somerville, Mass.; Milwaukee, Wis.; Joliet, Ill.; Escondido, Cal.; Cooper, Tex.; North Attleboro, Mass.; Clinton, Ia.; Saginaw, Mich.; Lake City, Fla.; Taunton, Mass.; Merrill, Wis.; Hamilton, O.; Grass Valley, Cal.; South St. Paul, Minn.; Cedar Rapids, Ia.; Dartmouth, Mass.; Fort Madison, Ia.; Suffield, Conn.; Adrian, Mich.; Sandusky, O.; Baton Rouge, La.; Northumberland, Penn.; Erie, Penn.

Water Department Motorized—It is stated that the water department in Hartford, Conn., is now completely motorized. The last car to be added was a 1.5-ton Pope-Hartford, made by the Pope Manufacturing Company of that city, and this is used for hauling the smaller sizes of pipe, tools, corded wood for the metal pot fires, and other material of that description.

Presents Ambulance to Montgomery—Realizing the splendid benefits arising from the possession of an automobile ambulance, James C. Haywood, Montgomery, Ala., has installed a machine of this character and announces that its use is free to the general public.

Buicks for Water Department—The Dayton-Buick Company, a new concern, organized recently to handle Buick cars, made by the Buick Motor Company, Flint, Mich., in Dayton, O., has secured a contract to supply the water works department of the latter city with two Buick machines of the roadster type.

Selects Federal Fire Wagons—For some time the city government of Lynn, Mass., has had two Federal trucks, made by the Federal Motor Truck Company, Detroit, in service, one with the water department and the other with the highway department. When the question of securing additional fire apparatus came up recently, the decision was soon reached to purchase Federals. Three pieces have been ordered.

Buys Additional Peerless Apparatus—Some six months ago the fire department in Cleveland, O., purchased six pieces of motor apparatus produced by the Peerless Motor Car Company of that city. The vehicles, which were of a new type then just being introduced by the Peerless concern, gave such satisfaction that orders have now been placed for three combination wagons and a hook and ladder service car.

Cars for Kansas City Police—The police department in Kansas City believes thoroughly in the practicability of the motor car. Several burglaries have been committed in the outskirts of the city, and motorcycle policemen have been assigned to these districts. In addition, three five-passenger touring cars have been purchased. During the day these machines will be utilized in suppressing speeding on the boulevards, transporting prisoners, etc. At night they will be held subject to call in an effort to apprehend house breakers.

Motor Weighing Machine—The Gregoire company of France has recently supplied to the police authorities in Paris a nine horsepower friction driven car, intended for the prevention of frauds in the sale of coal and other goods in bulk. The platform of the car is really a scales, which is brought into operation by means of four collapsible legs. When the weight inspectors, in their travels, decide to stop the vehicle and test the weight of the sacks, the four legs are fixed on the ground, which action slightly raises the weighing machine platform from the chassis.

PREPARING THE ANTI-FREEZING SOLUTION.

WITH the approach of cold weather preparations should be made to guard against the freezing of the water in the cooling system of the car, especially if the machine is subject to long waits in the open. Some do not advocate the use of anti-freezing solutions, relying upon their drivers to run the motor occasionally when waiting for a load and when it is very cold. There are, however, a large number of operators who prefer to utilize such solutions and the accompanying tables showing the percentages of water and ingredients to employ will be useful in preparing the car for cold weather service.

There are several ingredients used and these are mixed in certain proportions, according to existing conditions and locality. The most common are alcohol, calcium chloride and glycerine, although there are several chemical solutions which can be purchased already prepared.

ANTI-FREEZING SOLUTIONS AND THEIR FREEZING POINTS.

Mixture		Degrees F.
Calcium Chloride.		
1 pound salt—1 gallon water	Freezing point	27
2 pounds salt—1 gallon water	Freezing point	18
3 pounds salt—1 gallon water	Freezing point	1.5
4 pounds salt—1 gallon water	Freezing point	—17
5 pounds salt—1 gallon water	Freezing point	—39
Glycerine.		
Water 95%—Glycerine 5%	Freezing point	30
Water 90%—Glycerine 10%	Freezing point	28
Water 85%—Glycerine 15%	Freezing point	25
Water 80%—Glycerine 20%	Freezing point	23
Water 75%—Glycerine 25%	Freezing point	19
Water 70%—Glycerine 30%	Freezing point	15
Water 65%—Glycerine 35%	Freezing point	12
Water 60%—Glycerine 40%	Freezing point	5
Water 50%—Glycerine 50%	Freezing point	— 2
Water 45%—Glycerine 55%	Freezing point	—10
Alcohol and Water.		
Water 95%—Alcohol 5%	Freezing point	25
Water 90%—Alcohol 10%	Freezing point	18
Water 85%—Alcohol 15%	Freezing point	11
Water 80%—Alcohol 20%	Freezing point	5
Water 75%—Alcohol 25%	Freezing point	— 2
Water 70%—Alcohol 30%	Freezing point	— 9
Water 65%—Alcohol 35%	Freezing point	—15
Water 60%—Alcohol 40%	Freezing point	—23
Water, Alcohol and Glycerine.		
Water 95%—Alcohol-Glycerine 5%	Freezing point	28
Water 90%—Alcohol-Glycerine 10%	Freezing point	25
Water 85%—Alcohol-Glycerine 15%	Freezing point	20
Water 80%—Alcohol-Glycerine 20%	Freezing point	15
Water 75%—Alcohol-Glycerine 25%	Freezing point	8
Water 70%—Alcohol-Glycerine 30%	Freezing point	— 5
Water 67%—Alcohol-Glycerine 33%	Freezing point	—15
Water 60%—Alcohol-Glycerine 40%	Freezing point	—23

Alcohol Solution.

The alcohol solution is favored because it is easily handled and is a clean mixture. It gives off an odor when heated, however; boils at 172 degrees Fahrenheit, and when used to withstand temperatures below zero heats readily, especially in mild weather. As it evaporates easily under such conditions, it requires attention and the use of a hydrometer to prevent subsequent raising of the freezing point. In radiators having a tendency to leak, this mixture will find these openings on warm days. Denatured alcohol is not expensive and as it may be procured readily, it is generally used.

Calcium chloride, pure, is in the form of prismatic crystals, soluble in one-quarter of its weight in water, and dissolves easily in alcohol.

The commercial form is not expensive and the process of dissolving it may be hastened by using warm water and stirring the solution. In preparation, one should have several strips of blue litmus paper for testing the mixture. If the paper changes to a red color the fluid is slightly acid and should not be used until corrected. This is accomplished by using a slight quantity of milk of lime, adding till color of paper remains unchanged. Crystallized calcium chloride contains about 50 per cent. of water of crystallization and dissolves in about half its weight in cold fluid; consequently, eight pounds of the ingredient dissolved in .5 gallon of water will make one gallon of the saturated solution.

Glycerine and Alcohol.

Glycerine and alcohol are favored by some, but the former is not recommended by some writers because of its alleged deteriorating effects upon the rubber piping. This is not true, however, as the disintegrating effect is upon the compound of the hose, and the action is more noted when the fluid is hot. Glycerine possesses wonderful solvent qualities, dissolving most substances that are soluble in water and some others, for instance, the metallic oxides. It occurs as an oily liquid of specific gravity 1.269, and its boiling point is 554 degrees Fahrenheit. It extracts water readily from the air and when utilized as an anti-freezing solution the connections should be made as tight as possible, for glycerine "creeps", the analogy being the creeping of the electrolyte on the top of a storage battery. This does not dry up, but rather increases, owing to the hydroscopic properties of sulphuric acid. The use of glycerine and alcohol, while more expensive, makes a good mixture in that the former does not boil as readily as other solutions.

In utilizing anti-freezing solutions allowance should be made for the expansion by heat. Where water is employed in the radiator and the container is filled to the top, after a long run the cooler shows a loss. This is due to the expansion and consequent overflow and sometimes to air pockets in the water jackets or piping, which space is replaced by the fluid. When such a loss occurs by evaporation or leakage, the solution should be brought up to its full strength, alcohol by tests with a hydrometer, and calcium chloride by the use of litmus paper. When these are not obtainable a full strength solution should be added.

Previous to the use of anti-freezing solutions the components of the cooling system should be thoroughly cleaned. A mixture of common washing soda and water, is suited for this work. The crystals are added until no more will be dissolved, and after introducing in the radiator, the engine is run for some little time, after which the mixture is removed and the components flushed out with clean water.

FOREIGN TRUCK NOTES OF INTEREST

SCHNEIDER ARMORED WAGON.

New Type of Vehicle of Which Spanish Government Has Purchased 24 for Its Army.

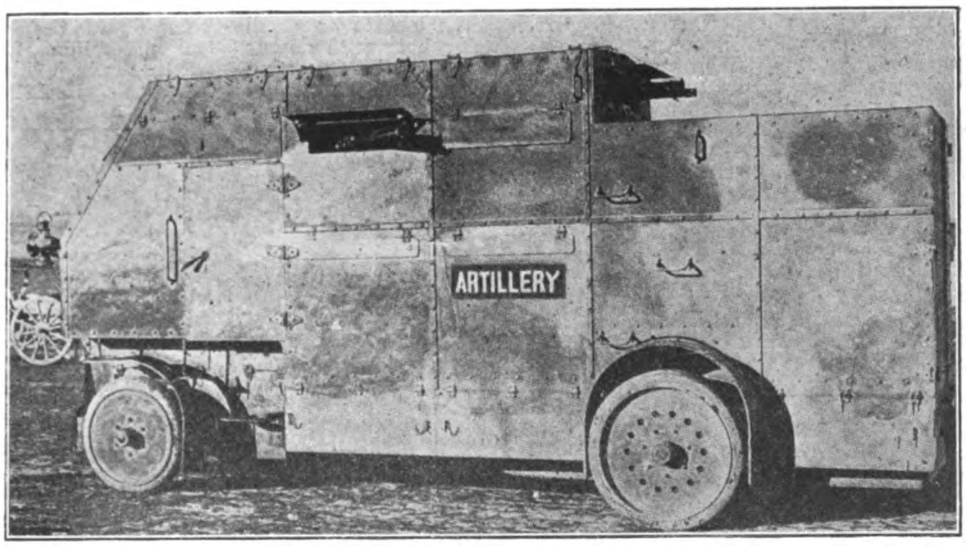
An interesting type of military motor is to be found in the Schneider armored wagon, made by the French firm of that name for the Spanish army. The chassis is that of a standard Schneider truck, fitted with a four-cylinder gasoline motor, with bore of 4.9 inches and stroke of 5.5, rated at 40 horsepower at 1000 revolutions a minute. The cylinders are cooled by water, thermo-syphon system, the radiator being provided with a belt driven fan. A Hele-Shaw clutch drives to the three-speed transmission, final drive being by shaft to a live rear axle. The wheels are of wood, artillery type, shod with rubber and protected by .25-inch sheet metal discs of steel.

The body is divided into three compartments. The front comprises a covered cab for the driver's seat, which is located over the engine. The main portion is in effect a small block house for the accommodation of the men in charge of the quick firing guns. At the rear is the storage space for ammunition.

The front portion of the armoring protects the radiator, the engine and principal mechanical parts. There are two seats in front, that for the driver being at the left, while that at the right is fitted with a folding back and is intended for the commanding officer. Two doors, one at each side, give access to the seats and the interior of the car. There are four movable shutters in front and two at the sides, permitting inspection of the road, etc.

The net available space in the central portion is: Length, six feet six inches; height, six feet four inches; width, five feet seven inches. This is reserved for the riflemen and the men in charge of the quick firing guns, and two longitudinal seats are provided for this purpose. These seats can be folded so as not to interfere with the firing, which, in the event of attack, can take place from both sides of the vehicle through eight shutters, four to each side, so placed as to permit firing in either a standing or kneeling position. An additional shutter at the rear is provided for rear action.

The net available space in the ammunition store is: Length, six feet six inches; height, four feet seven inches; width, five feet seven inches. It is maintained that from 2.5 to three tons of ammunition could be stored in this space if necessary. A folding door, fitted at the back, facilitates quick loading of the compartment. In front, this section is separated from the firing compartment by a vertical wooden partition, with a communicating door. The mechanical parts are protected by armored plate. It is held that this steel plate will give ample security against Lebel rifles at 165 yards.



Schneider Armored Wagon, of Which Spanish Army Now Has 24 in Active Service.

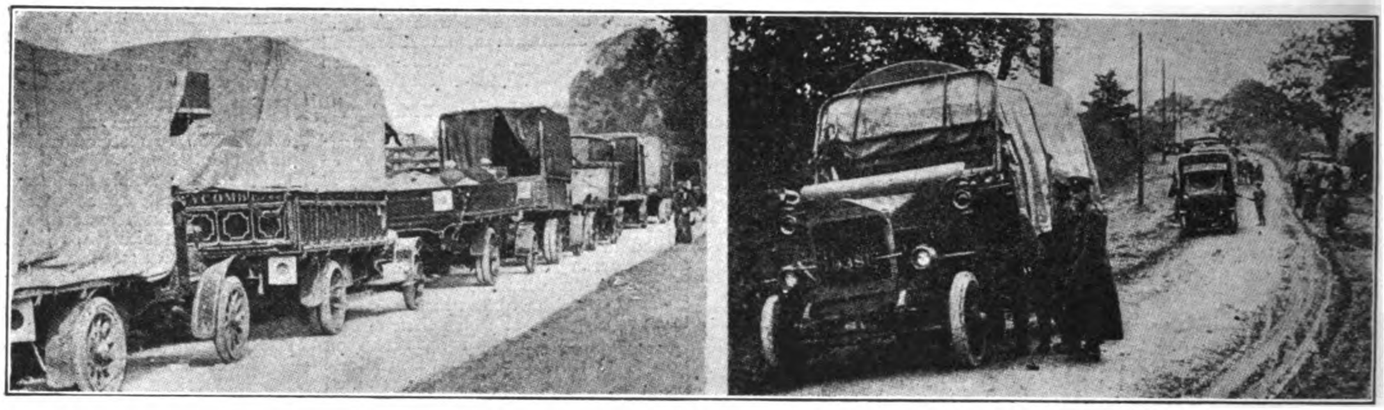
MOTOR AMBULANCE COSTS.

Interesting Figures Made Public by Scottish Hospital Using Argyll Machine.

Dr. A. K. Chalmers, medical officer of health for Glasgow, Scotland, has made public some very interesting figures concerning the cost of a 15 horsepower Argyll ambulance, made by Argylls, Ltd., Alexandria, Scotland, in service with the Ruchill hospital in Glasgow. The figures cover a period of 23 months, or from Dec. 26, 1910, to Nov. 22, 1912, and show an economy over horse drawn vehicles in similar service in the same city of about three pence a mile.

During the 23 months of the observation, the Argyll ambulance covered 19,674 miles, with a total cost of £719 1s 6d, or an average of 8.767 pence a mile, this including the wages, food and uniforms, while the horse drawn vehicle cost approximately one shilling a mile. It is difficult to determine the exact mileage of the horsed wagon, but from a thorough knowledge of the district covered this has been estimated by Dr. Chalmers at approximately 18,328.

These figures, in themselves, are by no means as interesting to the American, as the detailed figures for



Motor Vehicles Transporting Supplies During Recent British Army Manoeuvres: At Left, on the Road; at Right, Awaiting Transfer of the Loads to Horse Vehicles.

the automobile. These are given below, in both English and American money, and their consideration must be governed by the knowledge that the retail prices differ materially in the two countries, as well as the matter of wages. The total cost of the several items with the Argyll ambulance is estimated to have been as follows:

	£	s	d	
Mechanical repairs	70	15	9	$344.49
Repairs to tires	45	14	3	222.46
New tires	148	4	8	721.38
Gasoline	152	14	2	743.16
Oils	10	5	8	50.04
Wages, including food and uniform	291	7	0	1417.86
Totals	719	1	6	$3499.39

MILITARY MANOEUVRES ABROAD.

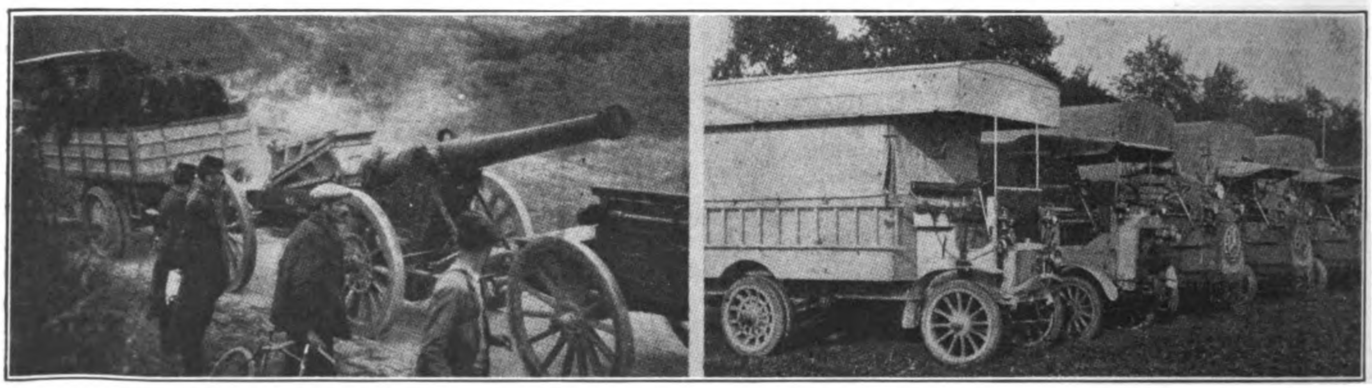
How Motor Vehicles Are Utilized by British and French Armies in Annual Trials.

Since the more general adoption of automobiles and motor trucks in the annual manoeuvres of the state militia in this country, there is increasing interest in the use of such vehicles abroad. It is more or less well known that the armies of Europe are plentifully supplied with automobile equipment, and it is at least suspected that they have carried experimentation of this character much further than is true of the United States government. Somewhat detailed reports concerning the recent manoeuvres of the British and French armies offer opportunity for judging more particularly in respect to this view of the situation.

In Great Britain, the military problem involved the sending of two separate armies against a third, which was supposed to be defending its position in its national capital. Some 58,000 men composed the two advancing armies, and the motor vehicles were utilized largely in bringing provisions, etc., from the railhead to central points, where the contents of the automobiles were transferred to horse wagons for distribution among the different divisions in the field.

It would appear from this statement that the British army officials already had been convinced of the impracticability of utilizing machines in the field, although this supposition can be sustained only by the absence of evidence to the contrary. The trucks followed the main highways, and there does not appear to have been attempt to utilize them in cross country work, their instructions being to follow the army's movement rather than to seek shorter routes to the predetermined rendezvous. In this respect, at least, the task set for the motor vehicles does not appear to have involved serious difficulties, or conditions differing materially from those which prevail at all times in highway haulage.

To each advancing army were assigned 35 1.5-ton wagons for the cavalry, and 24 wagons of the same capacity and one postal van for each of the other two divisions. It will be understood that not all of these vehicles were owned by the British government, but were largely of the so-called subsidized class. In ad-



Mechanical Transport in Recent French Army Trials: At Left, Panhard Four-Wheel Drive Tractor Hauling New Siege Gun and Crew; at Right, Part of the Aerial Corps' Vehicles.

dition, there was a column of 10 hired vehicles, not necessarily subject to subsidy, and 30 cars for the use of the Royal Flying Corps, besides ambulances and pleasure cars, the latter being employed by officers.

The French army had a somewhat more pretentious problem. Some 60,000 men were disposed within an area of 20 square miles, and it was the business of each division and sub-division to remain hidden so far as possible. Aeroplanes were employed to search out the hidden "enemy" and to communicate the information learned. Motor vehicles were utilized to transport the aeroplanes, and some of them were fitted as travelling workshops in order that the flying force should be hampered as little as possible in its work.

Quite contrary to the plan in Great Britain, the automobile division was expected to avoid the main highways as much as possible and to convoy its charges without detection. These charges included not only the aeroplane hangars and paraphernalia, but the machine guns, wireless telegraphy outfits, searchlight equipment, etc.

About a year ago the French army gave a preliminary test to a Panhard four-wheel drive tractor for hauling machine guns over rough ground. Seven of these were utilized in the recent manoeuvres, as well as others of the Latil make. Each train consisted of four vehicles; the tractor, an ammunition wagon, the gun and a second ammunition wagon. Each trailer wagon had a brakeman, and the rear vehicle carried the gun crew of from 10 to 15 men. The guns were of a new type, and it was estimated that each train supplanted from 25 to 30 horses.

Practically all the motor vehicles, including the gun trains, were sent across country and over crooked roads at various speeds, and in one instance they descended a 10 per cent. grade about .75 mile in length, only to take a hill of about the same length and with a 13 per cent. grade. Every attempt was made to have the conditions as nearly as possible what might be expected in time of war.

The one exception to the general rule was that of the wireless telegraphy cars. These were of the Delahaye make and worked in pairs, the first being equipped with the dynamo and transmitting current to the other, on which the wireless set was installed. They were called upon to do some cross country work, but only of the very easiest character. It may be added that this is a new type of vehicle with the French army, and is still regarded as in its experimental stage.

Twenty-four converted motor 'buses, of the usual De Dion-Bouton and Schneider types, taken from the regular Paris service, were utilized for transporting fresh meat and supplies of that character. The apparent object was to demonstrate that these vehicles might be available for such service in the event of war. Smaller vehicles were utilized by the headquarters staff as travelling offices. Several pleasure cars also were used by the officers. In fact, the demonstration was about as near horseless as it would appear possible to bring about with an armed force in the field.

GENERAL NEWS FROM ABROAD.

'Buses in South Africa—It is understood that the Municipality of Pretoria in South Africa is in the market for two motor omnibuses.

More Spanish War Vehicles—King Alphonso of Spain has issued a decree authorizing the minister of war to purchase, without formality of calling for bids, 40 40-50 horsepower motor trucks, with accessories, each with capacity of four metric tons.

Ambulances in New Zealand—The Wellington Hospital Board, Wellington, New Zealand, is making inquiries with a view to substituting motor ambulances for the present horse drawn vehicles. A company is being formed in that city for the operation of a motor 'bus line to serve the Pongaroa road.

Additional Motor Mail Vans—So successful has been the plan for utilizing motor vehicles in extending the mail service in the interior of England, that additional bids have been posted for a service between Doncaster, Rotherdam and Sheffield. The distance to be covered weekly is 255 miles, and the estimated load capacity must be 1300 pounds.

Studebakers on Display—During the recent 21st annual exhibition of the Grocery, Provision, Oil and Italian Warehouse Trades Association, held in the Agricultural hall, Islington, England, 11 machines of various load capacities were displayed by four manufacturers, as follows: Studebaker Corporation, Studebaker, three; Dispatch Carrier Company, Girling, three; Consolidated Pneumatic Tool Company, C. P. T., four; R. G. Motor Company, R. G., one.

No 1914 Olympia Display—The Society of Motor Manufacturers & Traders of Great Britain has decided against the holding of a commercial vehicle display at Olympia, London, next year. This action was forecasted, although there was some hope on the part of newer manufacturers of this type of vehicle that the objections would be overcome. It would appear that the only organized showing of motor trucks and wagons in England during 1914 would be that in Manchester in January.

Motor Train for the Czar—The Czar of Russia has just taken possession of a motor train kitchen, built for him in Germany. The train is composed of two vehicles, one of which is the kitchen proper and the other might be termed the pantry. The kitchen is equipped with a stove with five burners, a boiler, a refrigerator and cupboards for the imperial silver. Twelve seats can be fitted into place in a few minutes. The other vehicle, which accommodates eight or 10 persons, has receptacles for carrying provisions, and the seats are so arranged that they can be made up into a very comfortable bed on short notice.

New Commercial Car Accessories

A. A. S. Fibre Tubing.

Hard fibre tubing may be utilized for a number of purposes, such as carrying the high-tension wires, making bushings, etc. Being tough and flexible it permits of drive fits without danger of breaking and it also may be machined and cut easily. The American Auto Supply Company, 1741 Broadway, New York City, and 1408 South Michigan avenue, Chicago, is marketing hard vulcanized fibre tubing, which comes in 24-inch lengths and inside diameters of 1.125 and 1.5 inches. The thickness of the walls is .09375 inch. It is inexpensive.

Apco Anti-Rattler.

The Auto Parts Company, Providence, R. I., maker of Ford specialties, has brought out a new accessory for eliminating the play in the ball end of the steering arm. The device is adjustable. It replaces the usual steel cap on both ends of the steering gear connecting rod, which, when adjusted by filing the halves of the ball socket, usually results in the part binding when the wheels are turned. This is due to the difference between the worn, flat and round part of the ball. The Apco device consists of a bronze shell adjusted by means of a screw plug in the base. The shell member also contains a spring, which holds a steel stud in contact with the ball, resulting in a cushioning effect, and thus in easier steering. The new device is moderately priced.

Doxameter.

The Doxameter is manufactured by the Doxameter Company, Chicago, and differs from the conventional types of devices fitted to the intake pipe of a motor in that it is controlled by the accelerator. It is claimed that by its use not only is the supply of fuel controlled, but a considerable saving is effected as well. It is held that it facilitates combustion in that complete vaporization of the gasoline is made possible. A plunger member, controlling the amount of air, is connected to the accelerator mechanism.

The-Tell-Tale Gasoline Gauge.

Any device saving time makes for economy with commercial vehicles. The Bundy-Goebel Manufacturing Company, Detroit, is marketing an ingenious device for indicating the amount of fuel in the tank, which may be read at a glance. The-Tell-Tale gasoline gauge is not only compact, but it is stated that it may be fitted to the tank in less than two minutes, and after after installation requires no attention. The use of the device does not interfere with replenishing the supply of fuel as the liquid is poured through it, a filler cap of neat appearance being provided. The gauge is oval, one section comprising a calibrated face, over which moves an indicating hand. The-Tell-Tale gauge is constructed for different types of cars and is inexpensive.

Weld Extra Jet.

A device termed the Weld extra jet and designed to make easy the starting of the motor without priming in cold weather is being marketed by the Weld Manufacturing Company, North Chatham, Mass. It is controlled from the seat, a small, compact lever being employed, which may be actuated by the foot. The principle of the extra jet is that of providing a rich mixture for starting and operation until the motor has become sufficiently warm to operate efficiently under the normal mixture. The Weld differs from the usual types of priming devices in that the fuel is completely vaporized, properly mixed with air and conveyed to the intake manifold in proximity to the cylinders, thereby eliminating opportunity of condensation through long contact with the cold, metal walls of the intake pipe. The extra jet takes gasoline from the float chamber of the carburetor, and as the opening is above the level of the fuel, leaking is not possible. The size of the extra jet is approximately .75 by 3.5 inches. Connection from the jet to the actuating handle is by means of a small brass chain. It is stated that it is attached without soldering, only two small holes being required for an .125-inch pipe. In addition to making for easy starting, it is pointed out that the adjustment of the carburetor will not require changing to enrich the mixture for cold weather starting.

Typhoon Horn.

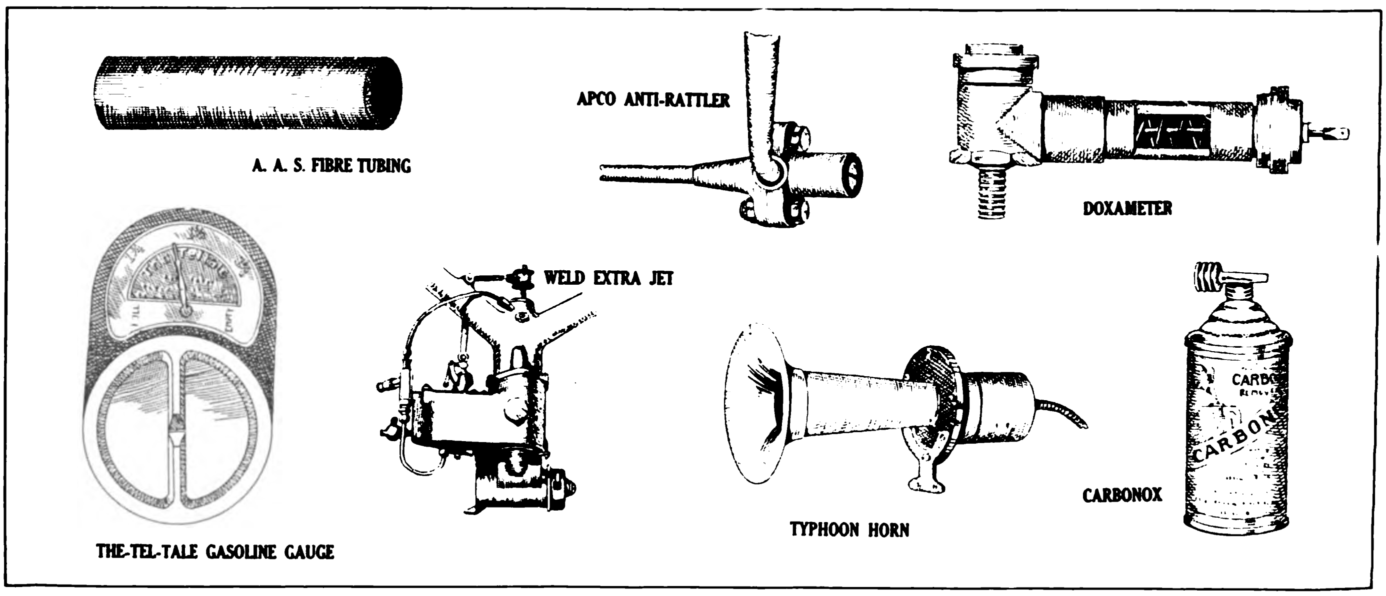
The Typhoon Signal Company, Chicago, is marketing a new style of Typhoon electric horn known as type F, and, although moderately priced, it is sold with a very liberal guarantee. It is made in two designs. One is for mounting on the outside of the machine and has a six-inch projector. It is finished in three styles, all black enamel, nickel and black enamel, and brass and black enamel. The other design is for placing under the hood and is equipped with a long projector to project the sound. It is finished in all black. The company points out that short circuitng is prevented by the use of a 7.5-inch flexible tubular connection for wiring to the horn, and that the construction eliminates the conventional need of terminals. The tone of the new signal is said to be very clear and penetrating and may be operated on any standard six-volt battery. The equipment includes full length wire cable and push button.

Carbonox.

The Northwestern Chemical Company, Marietta, O., is marketing Carbonox, which is a chemical carbon remover. It is stated that it does not dissolve the carbon, but attacks the charred oil that secures the flakes of carbon to each other and to the metal. By destroying this it is possible to blow out the deposits with the exhaust. To use, about half a pint is divided evenly among the cylinders by pouring it through the spark plug openings. It is allowed to stand for about 15 minutes, after which the engine is started. A detachable spout is supplied with each container and Carbonox may be injected into the cylinders much in the same manner as with an oil can, by exerting pressure on the bottom of the can.

Dayton License Number Holder.

The Dayton Malleable Iron Company, Dayton, O., is manufacturing two new designs of license plate holders. The front style comprises two right angle arms, also a clamping construction, fitting around the filler member of the radiator. The securing device differs from conventional design in that it is made to clamp around oblong or round filler members. It is locked by a bolt and nut. The rear design is made with a combination socket, permitting its use with either round or flat lamp irons. Both styles are adjustable.



Illustrating Some of the More Recently Announced Accessories Applicable to the Commercial Vehicle, Repair Shop, Etc.

THE A B C OF MOTOR TRUCK IGNITION.

Part XV—Explaining the Construction and Operation of the Remy R L Magneto, an Inductor Type, Having a Single, Stationary Winding, and Producing a Low-Tension Current Which Is Transformed by a Coil.

By C. P. Shattuck.

AS PREVIOUSLY stated the inductor type magneto may be either a direct high-tension or a primary armature type. An example of the true high-tension magneto was shown in the K-W instrument, the components and operation of which were fully described and illustrated. It will be remembered that with this direct high-tension magneto a single ignition system is provided in that the motor is started by electricity supplied by the instrument itself. It operates on the inductor principle, but instead of a single-wound armature a double is employed; that is, a secondary winding is utilized to transform the low-tension current into a high.

Advantages Claimed in Inductor Type.

The inductor type of magneto was long employed by the Remy Electric Company, Anderson, Ind., and it differs materially from the K-W in that a dual system of ignition is provided, a set of dry cells or a storage battery furnishing current for starting and as an auxiliary source of energy. Advantages claimed for the instrument are: Dual ignition with one set of spark plugs; the elimination of rotating windings, sliding and wiping contacts and collector rings, and a very hot spark. Another feature of the Remy magneto is that the break of the platinum contact points can be adjusted from the exterior of the cam housing and with the motor operating. This enables a quick adjustment, as well as permits the operator to note easily the results of his work.

The simplicity of the producing elements is shown at Fig. 80, which illustrates the principle involved. It will be noted that the winding is mounted between two inductors and that two leads extend from the winding. The latter is of coarse wire (primary), and this member is stationary at all times, being rigidly mounted between the pole pieces, to which are fitted permanent magnets. To a solid ground steel shaft are secured two simple inductors of laminated steel, one on either side of the winding. This shaft rotates on ball bearings and at each half-turn of the inductor shaft, the direction of flow of the lines of magnetic force through the winding is reversed, producing in it two electrical impulses for each complete revolution. The current obtained, therefore, is of an alternating nature.

Construction of Inductor.

The model R L Remy is shown at Fig. 79. It is a two-double-magnet instrument, weighing 21.75 pounds; is 7.5 inches long and 4.1875 wide over all. The stationary winding is held to be absolutely proof against oil, water and grease and, as it is stationary, it is not subjected to stresses. The inductors are built up of steel laminations, insulated to prevent eddy currents, and are balanced by the use of non-magnetic material to eliminate bearing strains. The magnets are of the best grade tungsten steel.

The electricity generated is transformed into a high-tension current by a transformer or step-up coil, the stationary winding being directly connected through the magneto circuit breaker with the primary of the coil. The primary circuit is mechanically broken as with other instruments, by the separation of two platinum points in the cam housing, the break

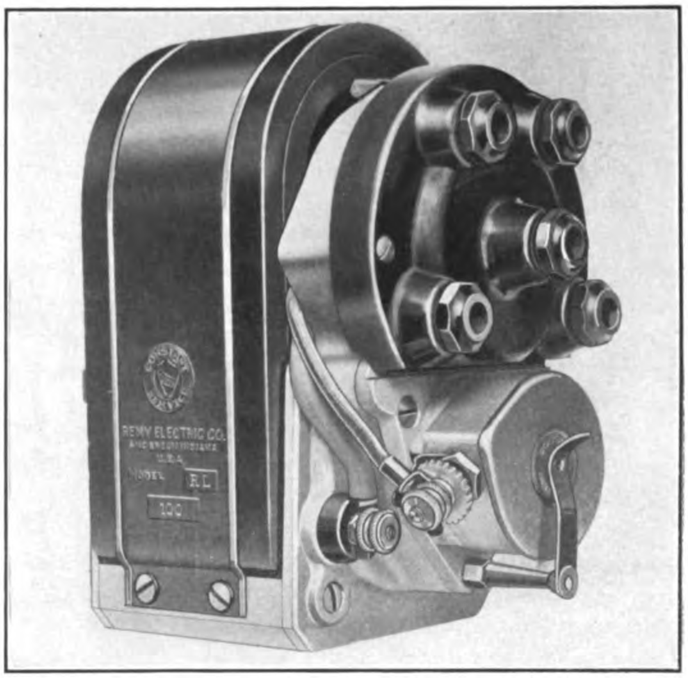


Fig. 79—Remy R L Magneto, an Inductor Type, Having Stationary Winding, and Generating a Low-Tension Current Which Is Transformed by a Coil.

taking place when the current has attained its highest value or efficiency, at which time the spark occurs at the gaps of the plugs. Variation in the time of the spark is possible, as the circuit breaker mechanism may be moved around the inductor shaft, to which is attached the circuit breaker cam. This operation of moving the housing is termed advancing and retarding the spark, the latter being utilized for starting and the advance for operating. The timing range is 35 degrees.

Operation of Magneto.

With the magneto supplying current, that is, the motor operating on electricity generated by the in-

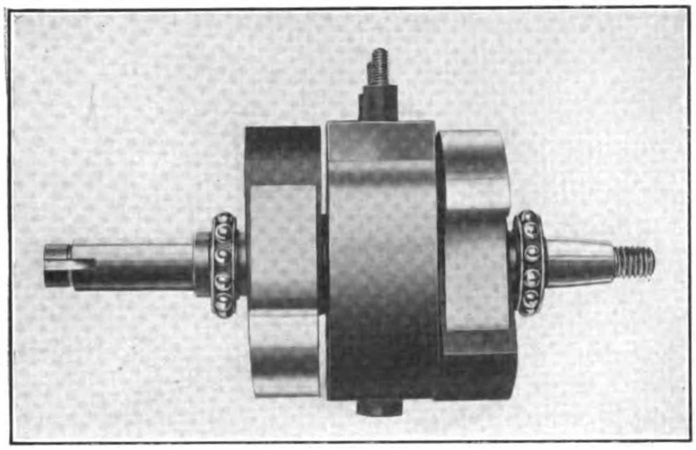


Fig. 80—Showing the Stationary Winding Between Laminated Steel Inductors, Inductor Shaft and Ball Bearings.

strument, the primary current is interrupted or the circuit broken twice every revolution of the inductor shaft. Each revolution, therefore, results in two high-tension impulses, as the magneto current is transformed by the coil and led to the distributor of the instrument by a single cable of sufficient size.

The distributor is actuated by a gear, this member being of bronze, and, with the four-cycle, four-cylinder magneto, twice the size of the driving gear mounted on the inductor shaft, so that the distributor segment will complete one revolution to two of the inductor shaft, as two complete revolutions of the motor crankshaft are made to obtain four impulses. These facts are of importance and have a distinct value, in that they must be considered in the installation and timing of the magneto. Similar gearing is employed for magnetos utilized with one, three and six-cylinder, four-cycle engines.

Components of Distributor.

The distributor of the Remy magneto is made of a well tried, heat resisting, insulating material known as Bakelite. It is non-hygroscopic and has an exceedingly high dielectric strength. The brass distributor segment, or that member conveying the transformed current from the coil to the proper terminals of the distributor housing, is molded in Bakelite and securely attached to the distributor gear. The small gear on the inductor shaft is of steel, the combination making

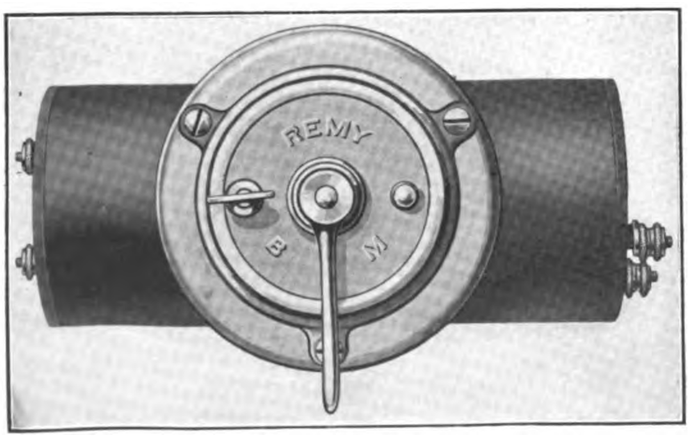


Fig. 81—Switch Utilized with Remy R L Magneto and Having Starting Button, Lock and Key.

for quiet operation, as well as for durability. These components are readily accessible by removing the distributor proper, which is also constructed of Bakelite. The condenser is enclosed in a metal case located in the arch of the magnets.

The circuit breaker mechanism is shown at Fig. 82, and the simplicity of the design is apparent at a glance. It comprises a housing which is free to move through a range of 35 degrees by means of a lever, which is connected by suitable rods, etc., and actuated by the spark lever on the steering wheel. Attached to the inductor shaft is a two-point cam, and in the illustration one of these projections is shown in contact with a pivotally mounted lever and in such manner that the lever is depressed, causing a platinum point mounted on the other end of the lever to move away from a fixed member secured to the cam housing. Each complete revolution of the inductor shaft causes the movable platinum point to make and break contact with the other member twice.

The fixed platinum member is adjustable, but is insulated from the metal of the cam housing and this insulation is secured by lock nuts as shown by the shaded sections of the drawing. Integral with the

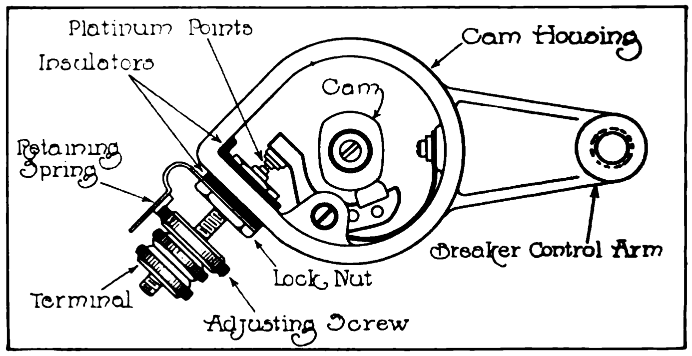


Fig. 82—Showing the Components of Circuit Breaker and Members Utilized in Making Adjustments—The Break May Be Regulated with the Motor Operating.

screw member is an adjusting screw having notches into which fits a retaining spring. The last named member prevents the screw from vibrating out of adjustment, but does not interfere with the rotation of the screw in either direction. A terminal is also fitted to the screw and is utilized for securing a primary lead, as will be noted in the wiring plans presented at Figs. 83 and 84.

Operation on Batteries.

When dry cells are employed, the battery current flows through the transformer coil and circuit breaker, being distributed to the spark plugs by the distributing mechanism, during which operation the magneto current is grounded. The transformer coil and switch are a unit, as will be noted by reference to Fig. 81, and with this arrangement only the switch appears on the operator's side of the dash. It will be seen that the switch lever may be moved to three positions, "neutral", "battery" and "magneto". It will also be seen that a push button is provided in the switch, and with the lever thrown to the battery side, pressing the button creates a spark, in that the primary circuit is closed

by the action. A high-tension current will continue to jump the gap at the plug as long as the button is depressed and the batteries supply current. It is assumed that when the motor stops the distributor is in a position to permit the high-tension current to pass to the terminal connecting with the spark plug of the cylinder on compression.

Direction of Drive, Etc.

The Remy magneto is designed to be operated in one direction only, and must be positively driven either clockwise or anti-clockwise, the direction being indicated by an arrow on the driving end of the inductor shaft. In installing, care must be taken not to have the cap screws or studs project more than .5 inch into the magneto base. Drive by an Oldham coupling is recommended by the maker.

Magnetos employed with four-cycle motors must be driven or geared at the following speeds: Two and four-cylinder, crankshaft speed; three-cylinder, three-quarter crankshaft speed; six-cylinder, 1.5 crankshaft speed. With two-cycle motors: Two-cylinder, crankshaft speed; three-cylinder, 1.5 times crankshaft speed; four-cylinder, double crankshaft speed; six-cylinder, three times crankshaft speed.

Timing the Magneto.

In timing the magneto, the motor is cranked until the piston of the first cylinder (that nearest the radiator with a four-cylinder engine, for example,) is at the top of the compression stroke. A timing button is provided at the top of the distributor and the magneto shaft is rotated by hand until the plunger of this button is felt to drop into a recess on the distributor gear. This device saves the operator from removing the cover to note the position of the segment, etc. With the magneto in this position the driven shaft is connected to the driving member. When secured in this manner the distributor segment is automatically brought into the correct position and will be in contact with the No. 1 terminal. The high-tension cable from the distributor terminal marked No. 1 is then connected with the cylinder having its piston on compression. The remaining wires are installed according to the firing order of the motor. In fitting the wires it should be remembered that the distributor rotates in a direction opposite to that of the inductor shaft.

Wiring Plan of System.

The wiring of a four-cylinder installation is shown at Fig. 83, it being utilized with the L E switch and coil. That at Fig. 84 is a six-cylinder installation. It will be noted that the wires employed are colored, a red lead going from the coil to the ground terminal on the magneto, a yellow to the contact screw on the cam housing and a green to an insulated screw post as shown in the drawing. The three colored wires of the primary cable must be connected with terminals of similar color on the coil. The battery connections are outlined in the diagrams and the various connections and path of the currents should be easily traced with a little study.

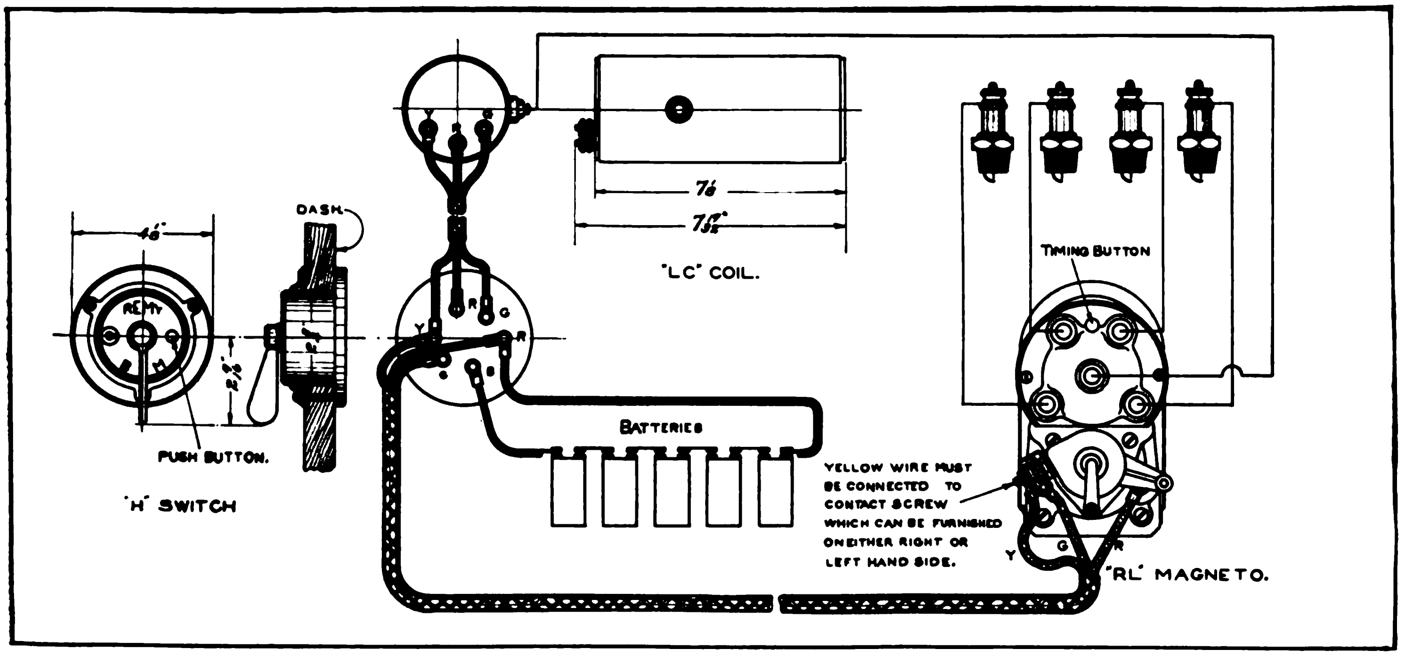


Fig. 83—Wiring Diagram of Remy R L Magneto for Four-Cylinder Motor with H Switch and L C Coil—All Connections and Wires Are Colored to Simplify Installation.

Battery Voltage.

Either a six-volt storage battery or five dry cells connected in series may be utilized, and either side of the battery may be connected to either coil battery terminal. If other electrical apparatus is utilized on the machine, and requires a ground connection, the grounded side of the cells should be connected to the coil battery terminals marked R with the L E coil or to the red wire of the two battery wires projecting from the type D switch. Although the circuit breaker control arm is supplied on either side of the cam housing as convenience demands, in every case the yellow wire must be connected to the platinum pointed contact screw.

Gap of Spark Plugs.

The maker recommends that the gap of the spark plugs be set to a definite point, from .025 to .03 inch.

If the motor misses when running idle or under light loads, the gap may be increased slightly and the result noted. If the motor shows a tendency to miss at slow speeds and under heavy loads the space should be decreased.

To obtain the best results from the magneto the gap between the platinum circuit breaker points should be from .02 to .025 inch, although variation may be made to meet the requirements of the motor. The adjustment of the points is obtained by pressing the retaining spring outward and rotating the adjusting screw. The points should have a smooth surface, as well as be clean. They are readily accessible by displacing the cam house lid, or the cam house may be removed as a unit. Dirt or grease should not be allowed to accumulate on the points, which will require attention but once or twice during an entire season of service.

In rewiring the magneto, all leads should be kept from contacting with or coming near the exhaust manifold or pipe. The high-tension leads—those running from the distributor to the spark plugs and from the coil to the magneto—should be kept separated. If the wires are retained in a metal clamp it is best to utilize some insulation between the metal and the cables.

Lubrication.

Two oilers are provided, one at the rear of the magneto and the other just back of the top of the distributor. Each of these should receive about two or three drops of lubricant every 1000 miles. A good, light oil is best and flooding should be avoided.

(To Be Continued.)

Ed. Note—The next installment will deal with the Mea true high-tension magneto, which differs materially from conventional design in that rocking magnets are utilized, etc.

AUTOMOBILE SCHOOLS MERGED.

The West Side Young Men's Christian Association Automobile School, at Eighth avenue and 57th street, New York City, has absorbed the New York School of Automobile Engineers, at 146 West 56th street, New York, and they are now one institution, being located at the Y. M. C. A. school. The equipment has been consolidated and the facilities are now adequate for meeting practically any requirements made upon the school. The students enrolled in the New York school are now completing their courses in the Y. M. C. A. classes. The West Side school is one of the oldest, as well as the largest, in America, and the New York school was establishd in 1905. It was an excellent institution from every viewpoint.

The direct interest of truck owners and users in the Y. M. C. A. school is in the fact that it has arranged to give special instruction for drivers for service with trucks built by the International Motor Company. With the merging of the two schools a three-ton Mack machine was placed at the disposal of the motor truck department for giving students instruction in road driving, and the school now has the following International equipment: Saurer chassis, motor and clutch, Saurer transmission gearset and Saurer carburetor; Mack chassis, Mack motor, Mack clutch, Mack transmission gearset, Mack axle and Mack carburetor.

With the use of this equipment the students will have special knowledge of the Mack and Saurer machines of practically all sizes, and it is expected that this will make possible training that will be specially valuable. The school has numerous demands for men trained to have special knowledge of vehicles, and the International Motor Company has supplied the means for giving its customers the benefit of drivers who know Mack and Saurer machines thoroughly.

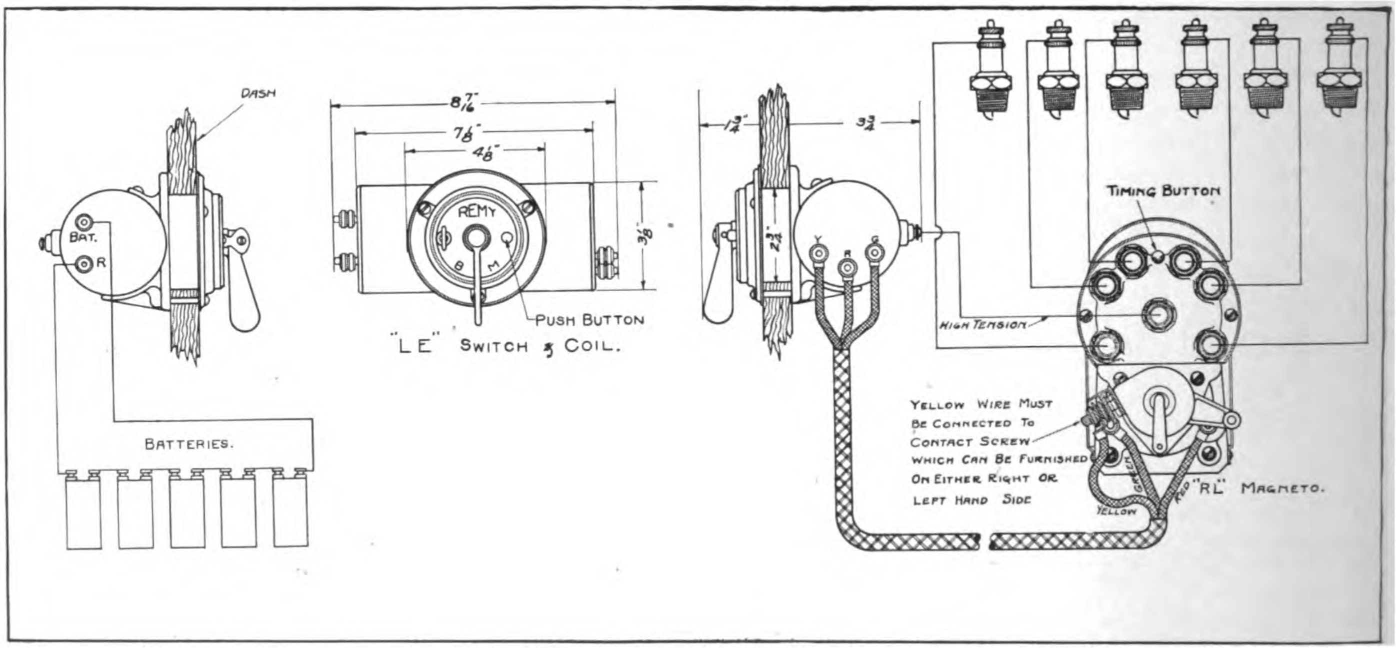
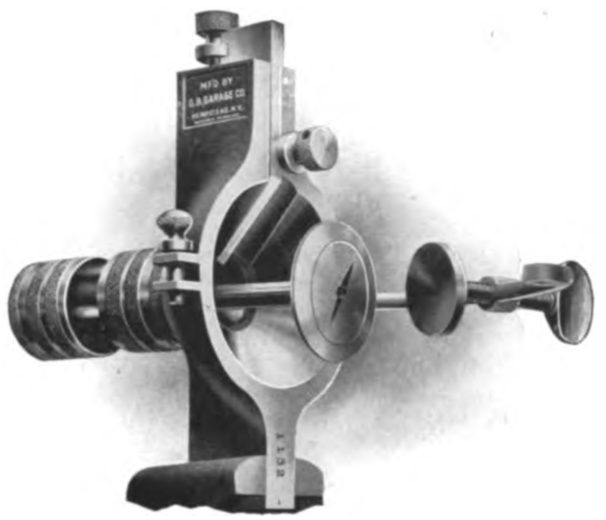


Fig. 84—Wiring Plan of Six-Cylinder Remy Magneto, Including L E Coil and Switch—In Connecting Leads from Distributor Terminals to Spark Plugs, Firing Order of Cylinders Must Be Observed.

GARAGE AND SERVICE STATION EQUIPMENT.

THE G. B. Sales Corporation, 1790 Broadway, New York City, is marketing the G. B. valve tool shown in an accompanying illustration, and the maker



G. B. Valve Tool

states that not only is considerable labor saved, but economy effected.

The equipment is for reseating as well as redressing the valves, and the maker states that it will reface valves to a perfect angle of 45 degrees and may be utilized with those of any size and material. The tool is so constructed that the valve must always be on centre when it is being dressed, insuring a uniform face. The device is also serviceable when ridges, grooves, pits, etc., are to be removed and which take considerable time when ground by hand.

The G. B. tool is the invention of George C. Bouthinon, who has had considerable experience in the manufacture of motor cars, and he designed it to save time in the factory. It is of drop forged, case hardened steel, the blade and seat cutter being of high speed, oil tempered tool steel, and guaranteed against defects in material and workmanship.

To use, the tool is clamped in the vise, a bridge member opened, and the blade disengaged by loosening a lock screw. The valve is then placed in the cone section and the knurling nuts turned to equalize the distance on both end threads, so that a roller bearing will be flat on the valve stem. The knurling lock nut is secured and the bridge closed, the latter being retained by a pin member. The blade is then adjusted and locked. The valve is rotated by a dog and feed is by thumb screw. The blades and cutters are sharpened easily.

LINDHE SHIMS.

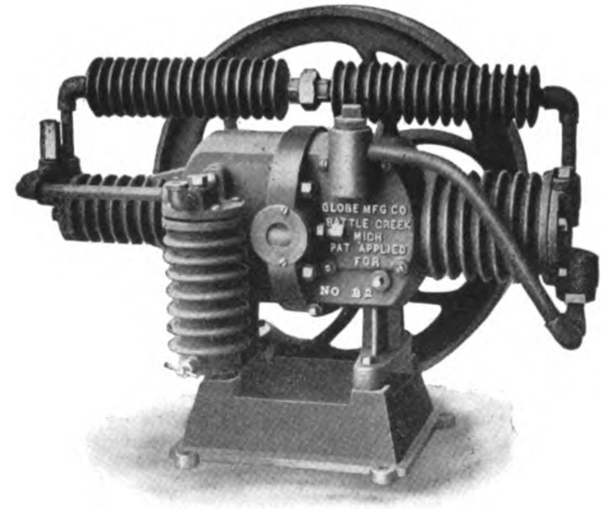
The Lindhe Shim Company, 212 Canal street, New York City, is marketing the Lindhe shims in two new sets. The first is known as the No. 1 and comprises one strip, .03125 by two by nine inches (all .002 inch laminations); .0625 by two by nine inches; .125 by two by nine inches; half the last two named are .002 inch laminations and half solid brass. The second set consists of similar sizes, excepting the laminations are .003 inch. By combining these different pieces almost any thickness of shim can be obtained.

MILLER STEAM VULCANIZER.

Charles E. Miller, Anderson, Ind., is marketing the Five-In-One steam vulcanizer, which has a circular surface and essential clamps for repairing eight tubes at the same time. The circular tube plate has four extensions for casings. The gas or gasoline burner is stationary, but the vulcanizer proper may be rotated as desired. Air bags are eliminated, as the outfit is operated with pad and clamp pressure.

GLOBE AIR COMPRESSORS.

Air compressors are a valuable addition to the service station and garage, as they may be utilized for a number of purposes. The Globe Manufacturing Company, Battle Creek, Mich., is marketing a line of air compressors to meet the requirements of service, including stationary and portable outfits. All are of the air-cooled type and it is stated that stuffing boxes, oil cups, piston packings, etc., are eliminated, and that all working parts are fully enclosed. One of the compressors is shown in an accompanying illustration and when in operation will develop and maintain 150 pounds or more pressure. The company also produces an automatic outfit, which keeps the tank constantly



Globe Air-Cooled Compressor Especially Constructed for Garage Service, Etc.

stored at a predetermined pressure. The company issues a catalogue in which are listed 20 types of compressors and each equipment is fully explained.

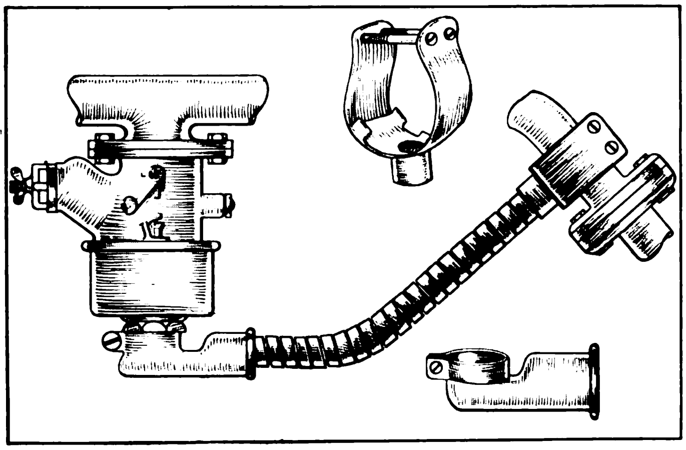
CORRESPONDENCE WITH THE READER.

Hot Air and Carburetion.

(50)—I would like some information on the use of hot air with the carburetor. Is there any advantage in heating the air and how does it affect the mixture? Can hot air devices be used with any type of carburetor? How is the device installed? Does it make starting any easier in cold weather? What is the best anti-freezing solution to use?
MOTOR TRUCK READER.
Burlington, Vt., Oct. 25.

Heating the carburetor may be by one of two methods; either by circulating the hot water around the mixing chamber or conveying heated air to the air intake. The latter method is becoming more popular, many car makers employing a flexible tubing for conveying the heated air of the exhaust pipe to the air inlet.

To understand the function of the heated air and its proper application, it should be borne in mind that the air drawn into the carburetor by the suction of the piston, passes over the spraying nozzle and the vapor is mixed with it, creating what is termed the mixture. The more perfect the mixture the quicker it burns and the more complete is the combustion. Rapid evaporation of the fuel is desirable and it is important that the mixture reach the cylinders without the value being changed, or without condensation.



Illustrating the Col-Mac Utilized for Conveying Heated Air to the Carburetor and the Connections.

It is held by one maker that the air should be taken as free from atmospheric moisture as possible. He maintains that dried air will absorb moisture, that of the vapor, much more quickly and more perfect carburetion is obtained as a result. Taking in dried, warmed air results in a slight expansion, but not to a harmful degree, as the cold of the vacuum in the mixing chamber absorbs the heat and contracts the air quickly to less than its original volume.

In an accompanying illustration is shown the Col-Mac hot air device attached to a carburetor and the connections are also outlined. In this instance a hood like device is secured to the exhaust pipe and by means of a flexible pipe secured to a clamp, it is possible to utilize the heat given off by the exhaust pipe. The Col-Mac is produced in sizes, etc., to meet the requirements of different installations, and the maker, the Breeze Carburetor Company, Newark, N. J., will supply details on request. It is necessary to mention the make and size of the carburetor and model of the car.

The use of hot air aids in starting a cold motor only after the initial explosions are obtained. It requires but little time for the exhaust gases to heat the walls of the pipe and it is obvious that any raise of the temperature results in facilitating the evaporization of the fuel. Another advantage is economy. When the car is not equipped with a pan or undershield, the hot air attachment prevents the entrance of foreign elements. The various anti-freezing solutions are discussed elsewhere in this issue.

Fitting Priming Cups.

(51)—I have a converted pleasure car, the motor of which is not fitted with priming cocks. The centre of the cylinder heads has a removable plug and provides an opening into the combustion chamber. Would it be practical to fit priming cups to this opening and what would be the approximate cost? The exhaust valve caps are too thin to use. INFORMATION.
Toledo, O., Oct. 14.

If the plugs referred to are of sufficient diameter, they could be drilled and tapped to take the priming cup. Priming cups are inexpensive and may be purchased from 20 cents to $1.50, depending upon their design. They may be obtained from any supply house. They are made in .125 and .25-inch pipe threads, with straight and angle shanks, also long and short. In fitting these members care should be taken to make them gas tight. The cost of preparing the plugs for the priming cups should be slight and the work could be performed in the garage.

Erratic Running Motor.

(52)—I am operating a 1000-pound delivery car and lately have experienced trouble with the motor acting queerly. With the spark and throttle set in one position and running on the level, the car will speed up, then slow down. Then, again, it will run all right. Have been over the ignition and it appears all right. Tank is clean and I have drained carburetor. The trouble is not steady, which puzzles me. What would cause this trouble? J. A. C.
Toledo, O., Oct. 10.

From the description it would appear that the trouble is due to the fuel supply; that either the pipe leading from the tank to the carburetor was partially clogged, or that a particle of dirt sticks in the spraying nozzle. Another cause may be that the float sticks at times, causing a dearth of fuel in the float chamber.

Shut off the fuel at the tank and disconnect the pipe at the carburetor. Next turn on the gasoline and note if it flows freely through the tubing. If so, the carburetor should be cleaned. Disassemble it and clean thoroughly, noting if the spraying nozzle is clean. Fill the float chamber with gasoline and note if the float is at the proper level and if it moves freely.

Use of Camphor in Fuel.

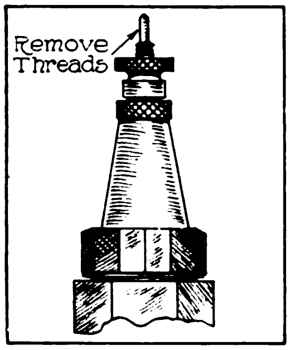
(53)—Will use of camphor in the fuel increase the efficiency of the motor and would you advise its use? SUBSCRIBER.
Chicago, Oct. 28.

According to tests conducted by an English engineer with two types of machines, there was no noticeable difference in the work of the engines nor was the mileage increased.

HINTS FOR PROPER MAINTENANCE.

IN ADJUSTING bearings of the ball type care should be taken not to have them too loose or too tight. In taking up lost motion considerable judgment must be exercised in screwing up on the adjusting member, not to get this too tight and impose an injurious end pressure on the balls. An excess pressure that will stress the bearing parts dangerously will not make much difference in the wheel resistance when turned by hand, though when the car weight must be sustained at high speeds or when going around corners, the resistance will be increased materially and bearing endurance reduced proportionally.

A safe rule to follow is to take up the wear by screwing in on the adjustment nut so that the shake or looseness will be eliminated, yet permit the wheel to spin for a few revolutions when given an initial impulse. Many drivers and even inexperienced mechanics commit the error of adjusting bearings of the take-up type too loosely. This is not desirable, any more than fitting parts too loosely together. Always lock adjustment nut firmly in place when the proper adjustment has been secured.



A Spark Plug Kink.

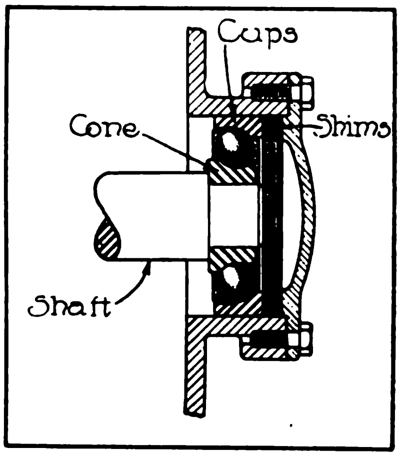
In some gearboxes and axles the bearings are shim adjusted. A number of thin washers of sheet brass may be interposed between the bearing cup and retainer cap, as shown in an accompanying illustration. When taking down an assembly of this nature always keep the shims from any bearing box together and tagged for future identification, to insure that the adjustment made in the factory will be maintained in the reassembly. If the bearings are loose for any reason, add shims about .005 inch thick to the others, until there is no appreciable lost motion and yet no binding between bearing parts. The above is an abstract from the ball bearing manual issued free by the New Departure Manufacturing Company, Bristol, Conn.

ADJUSTABLE TESTING SEAT.

Where there is more than one car to be cared for, an adjustable seat for testing the chassis out on the road after the overhaul is of value. In an accompanying illustration is presented a sketch of an easily made seat which can be constructed in the garage, and with very little trouble may be adjusted to fit any chassis, and shifted to accommodate either right or left hand steer.

The top member of the seat is constructed of a suitable length and thickness of plank, which is cut in two, the cut being made three or four inches from the centre, as shown. The side members or standards are of .875 or inch board and the top boards are screwed onto these. To prevent sidesway, angle irons are fitted, two to each standard.

The seat is made adjustable by boring two holes in the smaller boards and cutting two slots in the larger member as shown. Two mild steel plates .25 inch thick and nine long, with width equal to that of the plank, are employed to secure the two halves, bolts passing through the plate and slots in the seat. Four bars of .5 or .625-inch round iron and about eight inches longer than the seat overall, are threaded and fitted with nuts and washers. Four holes are bored in the side standards at a suitable pitch to allow the rods, when in position, to clear the chassis frame.

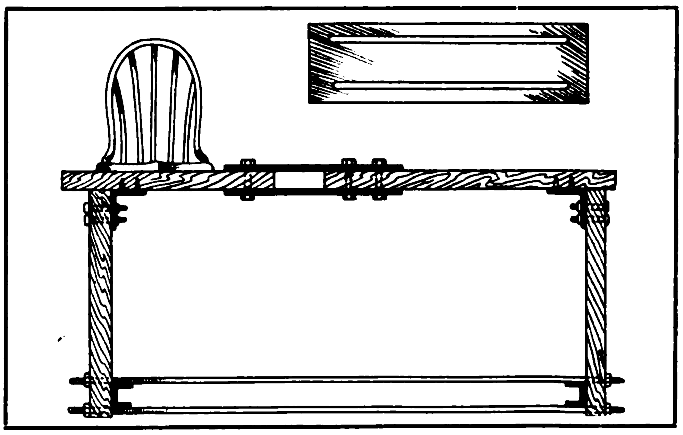


Shimming Ball Bearings.

To fit the seat to a chassis, it is placed in position, the rods fitted over and under the frame as shown, and the nuts screwed up snugly. As the bolts in the plates will slide in the slot during the fitting, these members should be loose while the seat is being placed on the chassis, but they are tightened in position after the rods are secured.

SPARK PLUG HINT.

The majority of drivers have experienced the annoyance of hunting for a nut, bolt, etc., that has fallen into the motor pan when making an adjustment of a part. The spark plug terminal is frequently a source of trouble in this respect. In an accompanying illustration is presented a suggestion for making it easy to start the terminal. Two or more of the top threads are filed off carefully, permitting of slipping on the terminal and catching a thread very easily.


An Inexpensive Testing Seat Adjustable to Any Chassis and Quickly Attached.

MARTIN & HUNEKE FUEL STORAGE SYSTEM.

A STORAGE system for handling volatile, inflammable liquids, which differs from conventional practise and presents many interesting features, is the

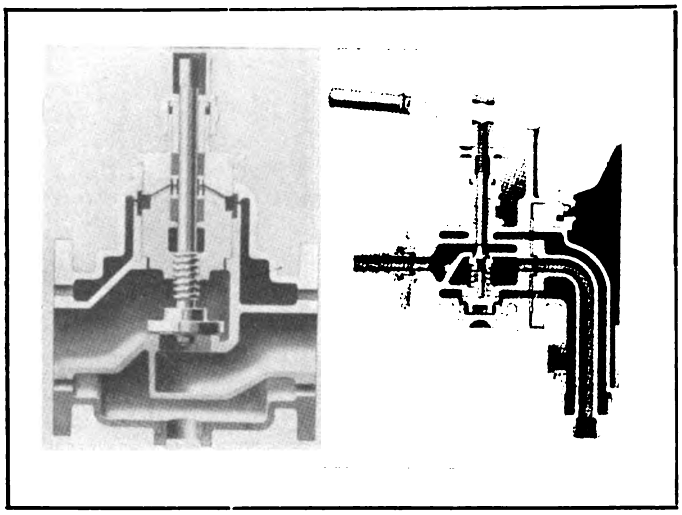


Fig. 1—Line and Draw-Off Valve Utilized with Martini & Huneke Fuel Storage System.

Martini & Huneke safety system, marketed by the Martini & Huneke Company, Woolworth building, New York City, which concern is affiliated with a large number of companies abroad where the system has been employed for the past eight years. As the application of the system is so varied only a general outline is given herein, but installations are made to meet varying requirements, whether for a manufacturing plant or a garage. The company maintains a corps of experienced engineers and is prepared to submit plans and specifications.

The most prominent features of the system are the means employed to prevent loss by evaporation, protection against fire or explosion and manner of handling the fuel, even when the main container is being filled. Another interesting feature is that leaks are instantly noted, it being possible to verify at once the normal operation of the system.

Throughout the apparatus in which the liquid is stored or handled, air is replaced by carbon dioxide (commonly known as carbonic acid gas) or other inert gas, which not only determines the movement of the liquid, but also serves as a protecting agent. This gas fills the jackets of all the pipes and valves, acting in such manner that the liquid can circulate only when the system is absolutely free of leaks. For example: If a leak occurs, the pressure of the gas will disappear and the liquid will remain in the tank, where there is no danger of explosion, since air is necessary to the formation of an explosive mixture.

The principle of the Martini & Huneke system is shown at Fig. 2, it comprising a storage tank of heavy sheet steel buried in the ground, inlet and outlet valves, a cylinder of compressed inert gas for protecting the liquid and for forcing it through the pipes, and jacketed pipes connecting the different parts of the system. The components shown are as follows:

1, storage tank, 2, 3, 4 and 5, anti-diffuser; 6 and 7, jacketed pipe connection to draw-off valve; 8, jacketed intake pipe; 9, carbon dioxide cylinder; 10, high pressure gas line to regulator; 11, pressure regulator; 12, low pressure gas line to storage tank; 13 and 14, jacketed draw-off valve; 15, mercury manometer; 16, liquid intake valve; 17, gas valve for equalizing pressure; 18, syphon for emptying drum; 19, shipping drum.

To charge the storage tank it is first filled with inert gas, then connected to the drum by means of a jacketed pipe and syphon. The pipes are provided with two valves, through one of which the liquid is syphoned into the storage tank, while the other permits gas from the storage tank to replace the liquid in the drum as fast as it runs out. This prevents any liquid left in the drum from coming into contact with the air and forming an explosive mixture.

The pressure of the gas in the main tank determines the height to which the liquid rises in the piping system, while the annular jacket space surrounding the distributing pipes is always in communication with the inert gas in the storage tank and assures an instantaneous return of all the liquid contained in the piping in case of any leak. In either case the liquid returns to the storage tank by gravity. As a further protection each pipe entering the tank passes through an anti-diffuser, which device serves as a safety valve, preventing the inert gas from leaving the tank and being replaced by air in the event the piping system is destroyed by fire. All of the outer pipes are fitted with fusible plugs, which melt at a low temperature, insuring a return of the liquid to the tank.

To draw the liquid it is only necessary to press the lever of the discharge valve shown at the right in Fig. 1, the fuel immediately rising through the jacketed pipe, owing to the pressure of the gas, and it con-

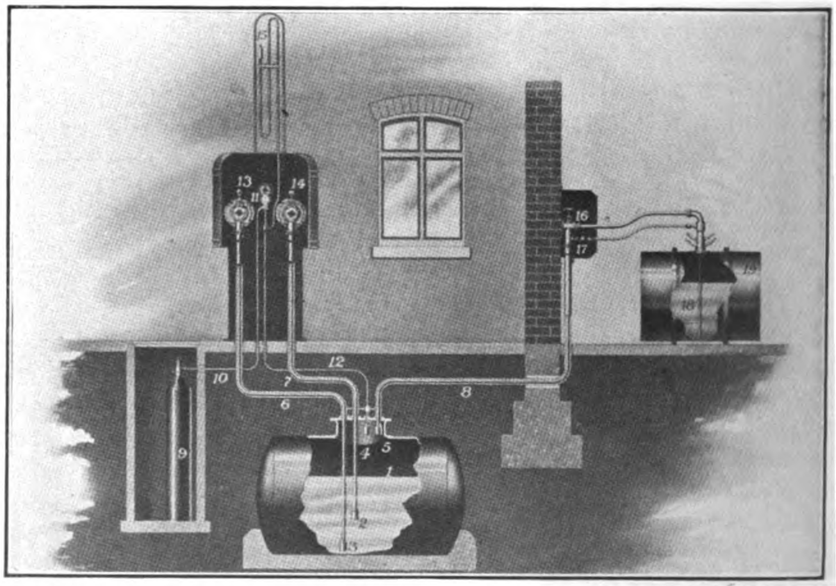


Fig. 2—Components of Martini & Huneke Storage System Employing Inert Gas and Having Many Interesting Features.

tinues to flow until the lever is released. The jacketed pipes referred to include an inner tube having three or more longitudinal ribs to keep the walls of the two pipes apart. The anti-diffuser operates on the principle of the Davy safety lamp; its upper part being filled with wire gauze admits either liquid or the gas, but prevents the passage of a flame into the tank. The bottom of the device is cupped to prevent diffusion of the gas in the tank after pressure has been reduced to that of the atmosphere, it being filled with liquid.

For small installations carbon dioxide gas, readily obtained, is utilized, but with large systems a special apparatus is supplied for producing an inert gas. A charging panel is also supplied, containing one or more inlet valves and connections, and a receptacle for the gas cylinder is included. Special measuring apparatus can be furnished to suit requirements as with conventional fuel storage systems. The Martini & Huneke system is also constructed for tank wagons and other carriers of inflammable liquids.

LIMITS MOTOR TRUCK WEIGHT.

Rules Restricting Capacity and Speed Now Effective in New York State.

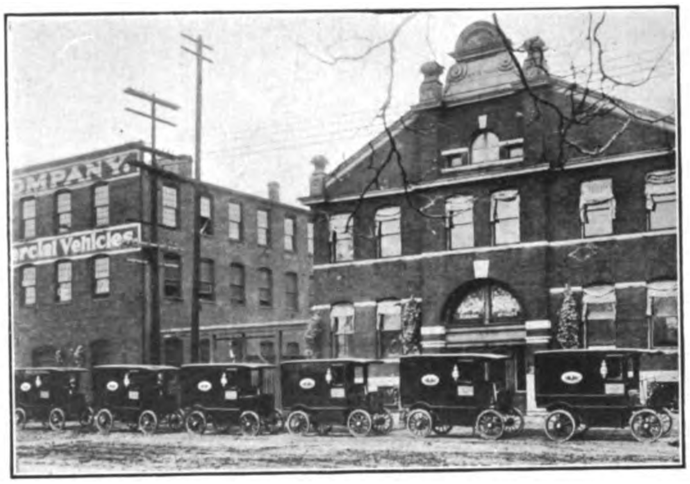
Rules promulgated by the commissioner of highways of New York State became effective Oct. 20, and these will obtain until they have been suspended by the same official, the regulating authority being conferred upon him by law. The rules provide that no tractor or traction engine, motor trucks or other power vehicle shall be driven on the roads if the wheels are fitted with cleats, flanges, rings, etc., to afford traction, but traction engines may be permitted to use cleats not less than 2.5 inches width and 1.5 inches thickness on all four wheels if not less than two cleats contact with the ground at the same time, and the weight is equally distributed on the cleats.

No power vehicle or traction engine or road roller that weighs more than 14 tons shall be used without a permit obtained from the state commissioner, this weight including both vehicle and load, and not more than eight tons shall be carried on one axle. The tires of the vehicles, aside from the exception noted, shall be smooth and the weight of the vehicle and its load shall not exceed 800 pounds for each inch of tire width. Permission to exceed this weight may be obtained.

The width of a motor vehicle is limited to 90 inches, but traction engines may be 100 inches. No vehicle carrying a weight of more than four tons, including the vehicle, shall be driven faster than 15 miles an hour, and no vehicle carrying a weight of more than six tons shall be driven faster than six miles an hour when fitted with metal tires, nor faster than 12 miles an hour when fitted with tires of other material than metal. The state commissioner may, at request, grant special permits to move vehicles weighing in excess of 14 tons subject to such prescriptions as may be imposed. Those violating the regulations shall be responsible for all damage to the highways and the value of the damage may be recovered by an action of tort brought by the state commissioner or the county or town superintendents of highways in the towns where the violation is noted.

CENTRAL STATION HAULAGE.

The New York Edison Company has just added six 1000-pound Waverley delivery wagons, equipped with panel bodies, to its transportation equipment, these being of a type that has been proven to be economical in delivery and maintenance work. The Waverley company has recently sold vehicles of the same class and power to the Edison Electric Illuminating Company of Boston, the Cambridge, Mass., Electric Light Company, the Commonwealth Edison Company of Chicago, Ill., the Denver Gas & Electric Company, the Louisville Lighting Company, the Merchants' Heat & Light Company of Indianapolis, the County Light Company of Pittsburg, the Duquesne



Six 1000-Pound Wagons, with Panel Bodies, Delivered to the New York Edison Company by the Waverley Company.

Light Company of Pittsburg, and the British Columbia Electric Railway Company of Vancouver, B. C.

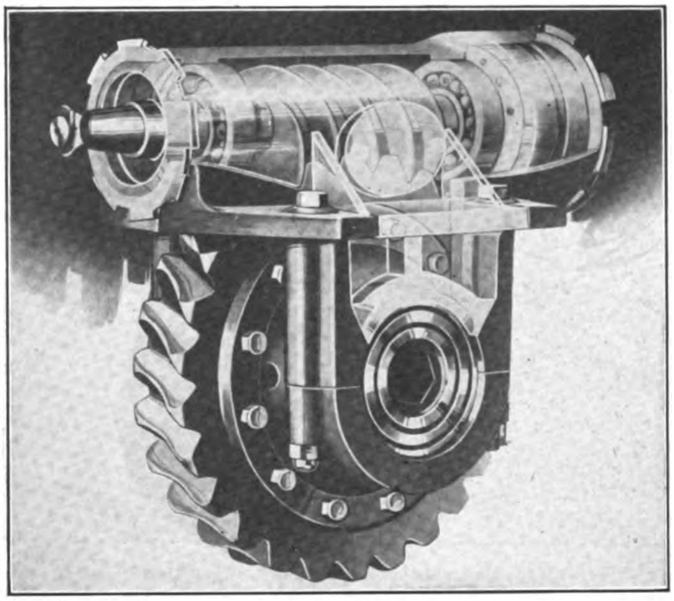
The experience of the Waverley Company is that there is a steadily increasing interest in electric vehicles with the central stations, and many of these firms are preparing to motorize their transportation departments, to say nothing of the constantly growing demand from business men and industries for machines that can be used in all kinds of urban haulage service. The possibilities of sale of current for charging purposes have received a great deal of attention from the public service corporations, and the practical promotion from use of electric machines has been taken up by a surprisingly large number of these concerns.

The Argo Electric Vehicle Company, Saginaw, Mich., which has experimented with electric tractors for upwards of two years, has perfected the design and will shortly begin the commercial production of these machines.

SHELDON WORM DRIVEN AXLES.

THE Sheldon Axle Company, Wilkesbarre, Penn., manufacturer of vehicle axles, springs, wheels and chassis parts, is now building a worm driven axle intended for wagon and truck service. This axle will be produced in several sizes for use with different types of vehicles. The demand for a power transmission system eliminating a second reduction of gearing has caused the use of the propeller shaft, and there is a limitation to the possibilities of this type of drive because of the extremely large size of the bevel gear when the reduction is greater than 4:1. The worm drive, however, permits a very wide range of reduction.

The worm and wheel of the Sheldon axle, together with the mounting of the differential, is shown in the accompanying phantom view illustration. In this it will be seen that three teeth of the gear wheel are al-



Phantom View of the New Sheldon Worm and Worm Wheel System of Transmission.

ways in engagement with the worm, and emphasis is made that with this construction there is greater strength than with the bevel gear, where but one tooth at a time takes all the weight of the load. The contact being sliding the worm and wheel drive is practically noiseless.

The Sheldon construction is non-adjustable. The carrier must be machined accurately to assemble the worm and wheel, and once assembled it is not adjustable, and can be removed and replaced without changing its alignment. Its efficiency increases with slight gradual wear. Worms and worm wheels have a minimum life of 80,000 miles, and when so worn that efficiency is impaired they can be replaced at moderate cost. As shown in the illustration the worm is mounted on two imported annular ball bearings and the end thrust is taken by a heavy duty double-thrust bearing. The differential is made of alloy steel and is of a size sufficient to enable it to endure under all loads. It is mounted on double-row annular bearings.

The axle housing is a single-piece casting of best grade steel. In testing the strength of a one-ton housing it was supported on 37-inch centres and a 50-ton weight deflected it .0625 inch. The casting resumed its original form with the removal of the weight. The high elastic strength of the steel, which is figured as about 80,000 pounds to the square inch, proved that the section modulus is more than equal to any stress that might result from road usage, and affords a factor of safety of at least 10:1 on the elastic limits of the material.

The Sheldon worm drive axles are a semi-floating type, in which special attention has been given the axle shafts. In the one-ton type they are 2.375 inches diameter at the critical point and made of 3.5 per cent. nickel steel, and are given a double heat treatment. The shaft end that fits the differential case is hexagonal, a construction that increases the section modulus of the shafts.

Both brakes, as with all Sheldon standard equipment, are on the rear wheels, the drums being 14 inches diameter and 2.5 inches face. The brakes are internal expanding and external contracting, the latter having special means of adjustment. Hubs for either steel or wood wheels are supplied, the tendency being to use the steel equipment. The company states that in England, where the worm drive has been used for years, the London General Omnibus Company uses 2700 omnibuses equipped with this type of drive. The average life of the worm drive with these vehicles is 83,000 miles, and one has been driven 124,000 miles.

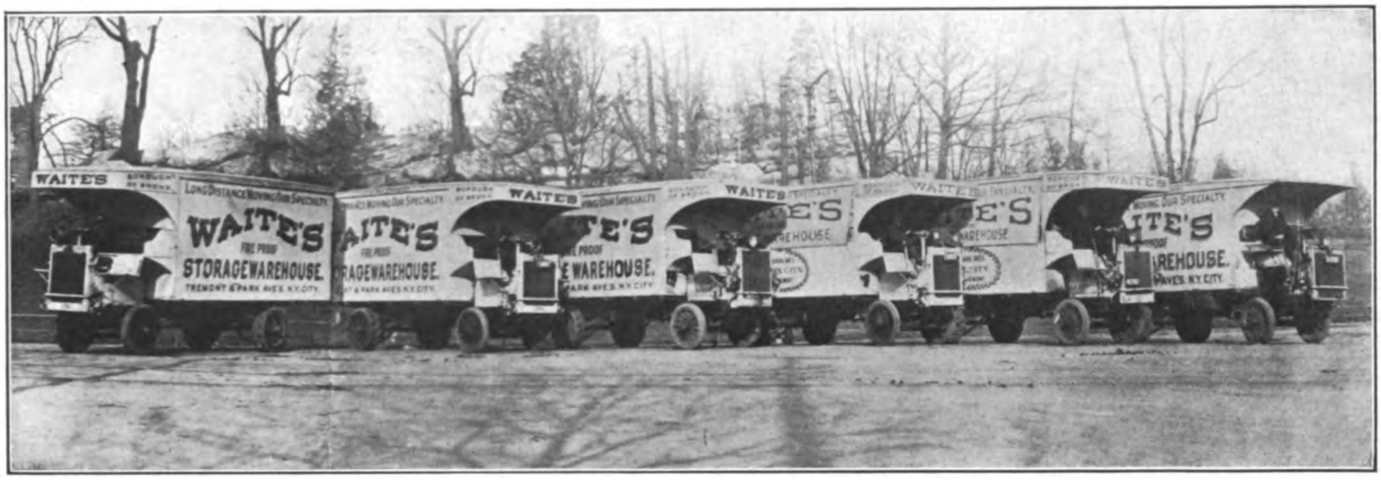
Robert S. Woodford, Jr., president of the concern, and S. Lawrence Bodine and Thomas L. Gaskill have been appointed receivers of the Standard Roller Bearing Company of Philadelphia, Penn., upon petition of the First National Bank of Philadelphia, and the assent of President Woodford has been given. The inability of the company to pay the interest or principal of its floating indebtedness and the refusal of a New York bank to renew a maturing loan is given as the cause. The purpose is to continue the business, for the statement is made that the assets exceed the liabilities and by conservative management the creditors can be paid in full and the interests of the stockholders protected. The company produces steel balls, ball and roller bearings and Rudge-Whitworth wire wheels. At the plant of the company at Philadelphia more than 1000 persons are employed.

The stockholders of the Reo Motor Car Company, Lansing, Mich., are to receive 60,000 shares of stock of the Reo Motor Truck Company, valued at $600,000, which was held by the former organization. The stockholders of the Reo Motor Truck Company recently received a dividend of seven per cent.

LONG DISTANCE FURNITURE HAULAGE.

Development of a Metropolitan Warehouse and Moving Business to Successful Competition with Rail and Water Lines Within Radius of 200 Miles with Motor Vans.

THE development of the business of Waite's Motor Van & Storage Company, at Tremont and Park avenues, Borough of the Bronx, New York City, by the use of motor trucks, is a striking example of the possibilities of transportation economy through specialized service, and the willingness of the people to take advantage of what is to them a decidedly better means of conveyance. This company is a competitor with railroad and steamer lines within a radius of 200 miles of New York and because of decidedly superior handling of freight carried it not only attracts patronage, but commands prices for the work that are very profitable. In other words, the company transfers household furnishings from one house to another within the radius stated and insures that the property will be hauled and delivered without loss or damage, and the delivery is so greatly expedited that a removal of residence is an undertaking of comparatively small proportions.



Six of the Fleet of Seven 3.5-Ton G. M. C. Trucks in the Service of Waite's Moving Van and Storage Company, Borough of Bronx, New York City.

Less than three years ago the company's business was confined to New York City and vicinity, all its work being done with horses, but with the acquisition of motor trucks its activities were extended, and it is now prepared to go to any point that may be desired, there being no limitation other than the price that must be charged for the special service that is afforded. Each year the radius is extended and hauls are made as far east as Providence, R. I., and to Philadelphia, Penn., and Wilmington, Del., at the south, while trips to Springfield, Mass.; Hartford and New Haven, Conn.; Trenton, N. J.; Poughkeepsie, N. Y., and other intermediate points are made very frequently. Removals of from 40 to 75 miles are as common as were those of a dozen miles with animals, and the majority of hauls of 100 miles are completed and the return made within the 24 hours. An example of service is the loading of a van, a haul of 189 miles, and the delivery of the freight in 19 hours, this work being done with a crew of a driver and two men, though the maximum crew of a truck is five. No attempt was made in this instance to make a record, but after loading the machine the trip was a straightaway run with stops only for meals and for replenishment of fuel and oil.

The company for years did a business largely in upper New York City, and transfer work was engaged in quite as much as removal of household effects, the establishment of a warehouse for storage in a fireproof building adding a department that attracted some patronage. The Bronx, which is a comparatively small part of New York, but covers a considerable area, is largely a residential section. Many people leaving the city to make residences elsewhere have stored their property, and the combination of transportation and storage attracted business that had previously been divided. Later on the possibility of having delivery made direct to the new home from the store house eliminated numerous inconveniences and personal attention, and the inquiries made from comparatively distant points for such transportation prompted the first purchase of a machine.

To understand clearly the conditions in which the business has been developed the statement should be made that railroad or water freight rates are the minimum that can be secured. In the event of household removal the railroad has practically two services and three rates. The first service is for shipment in carload quantities, which has a specified charge for each 100 pounds or fractional part for the distance. The second service is where less than a car is used and the rate is similarly based. For the first service, however, insurance against loss by theft, breakage, wreck or storm damage can be secured by the payment of a

higher rate. Where carload shipments are made without insurance the car is sealed and the railroad guarantees to deliver the car at its destination, but the owner assumes all risk and the car is supposedly delivered within a reasonable length of time. The haulage may take from a couple of days for 100 miles to a week or more. The car may go astray and delay result. But the contents of the car are not disturbed during transit.

With a partial carload the freight is more or less exposed because the car is opened for the removal of other property at different points, and there is greater possibility of theft or loss or damage, and the transit is necessarily slower from deliveries at several points. This method is less satisfactory than where an entire car is used. In shipment by water lines there is not the same security as with the railroad from the fact that the goods cannot be placed in compartments and the possibilities of loss are considerably greater. One means of protection, that is customary, is crating the property regarded as valuable, which must be done before transfer from the house to the car, and packing is only satisfactory and sufficiently protective when done by experienced men. On arrival at the destination the property must be uncrated, and while this is not so important, the work is considerable. Then to afford the best transportation by railroad the goods should be crated, sent in carload quantity and protected by insurance, and crating and insurance is necessary with water line shipments. Considering time, convenience and expense for a moment it is evident that crating and packing, haulage by railroad or water and uncrating, and the payment of insurance means that the cost will be considerably more than the actual freight rate, to say nothing of the probability of delay and the accompanying annoyances.

With this aspect of the ordinary means of transporting, the possibilities of specialized service, packing goods in large vans that would effectually protect them from dust, water and light, and delivery from the vans to the houses, appeared to be very attractive. Work of this character was done with animal vans within short distances, and the only question was whether the people would take advantage of the service of the company and be willing to pay sufficient charges to justify the investment. President W. A. Waite studied the subject from several angles. Assuming that a delivery was to be made 75 miles distant, this would mean that the price charged must be sufficient to pay for the time of the van and the men, and this must cover 150 miles actual travel for the vehicles and the services of the men; or, viewed from another light, the price for the haulage must cover the services of the men and vehicles, have a margin that would yield a profit and meet any travel exigency, permit insurance against fire, damage or theft while in transit, and yet be such as would be attractive to the public when contrasted with the rates exacted for other forms of transportation.

As stated, the special service would be expected to be more expensive than the ordinary, and the advantages would be the minimized handling, elimination of crates, quick haulage and ample insurance, but in addition the haulage to and from the railroad or water line terminal at either end of the haul would be a considerable item that would have to be added to the freight rates. The division of responsibility in the event of damage is another important factor. The aggregate cost of removal is not represented by the railroad rate, but it was believed that contract jobs would be profitable. There was reason to question the economy of motor trucks in locality transfer work from the fact that the greatest success could only be attained by keeping the machines busy constantly, and idle time would be more expensive with trucks than with animal vehicles. The question was of developing the long hauls and affording service that would justify prices that would be profitable.

President W. A. Waite decided to experiment and to this end in March, 1911, he bought a used 3.5-ton G. M. C. truck and equipped it to meet his requirements as a van. The old body was removed and in its place was installed a van body 16 feet length and seven feet width and height, giving a storage space of 784 cubic feet. The body was substantially built to adequately protect the goods against storm or dust. The walls were solid and the roof made heavy, with a high tail gate and double doors at the rear, so that the van could be locked and sealed. The roof of the body was extended over the dash and the end and sides of the hood or cab lowered so as to make a large compartment for the storage of tools, covers, spare clothing, etc., all convenient to the driver. The seat and footboards were replaced by new construction so that the original space under the seat was preserved, but the seat made wide enough to carry the driver and four men, the seat being the full width of the body.

In designing the van body it was made so that it would carry practically double the quantity of goods that could be carried in a horse wagon, and with a capacity of 3.5 tons the belief was that the machine would seldom be loaded to its rated load. For the purpose of obtaining the greatest advertising value the van was painted white and attractively decorated with gold lettering, and whenever it was sent away a large sign was placed at either side that notified all who might approach within a block that long distance moving was specialized. The machine was placed in service and the work through the spring was so satisfactory that the first new truck was ordered and delivered June 23, 1911. This was equipped with a very similar body, but full length double doors were built for the rear and the decorating was made more ornate and the removable signs were replaced by permanent lettering.

Mr. Waite found with experience that publicity was required, and besides the general knowledge obtained through the regular channels of the business and the appearance of the vehicles in the streets, he began a general distribution of mailing cards, these be-

ing circulated in all sections of New York and vicinity, being sent out by the thousand, and besides serving a very useful purpose in directing attention to his service, these had printed forms so that, at the cost of a penny stamp to sender, a representative could be summoned who could make estimate for any work. The fact that people were disposed to prefer the service given, and that the contracts could be made advantageously was evident from the demands, but the possibility of developing the return trips of the machines, especially when of considerable length and making two profits, was worthy of attention. Mr. Waite directed his attention to this development and in a comparatively short time began to obtain results, and today more than half the trips are with a load in either direction, thus materially increasing the productiveness of the machines.

The third machine was ordered and delivered Jan. 27, 1912; the fourth April 1, 1912; the fifth Aug. 6, 1912, and the sixth Sept. 15, 1912, so that during last year four vans were added to the fleet, these being equipped as were the second. Feb. 25 of this year the seventh van was delivered and all of these are now in use. The prospect is that others will be ordered. As the machines were bought the number of horse vans was reduced, it being found that the trucks could be worked advantageously on short hauls and that sufficient contracts could be made to keep them busy. In fact, during the seasons of the year when people remove from the city to the country or the shore, or vice versa, the vans are worked a great deal of the time, which would not be possible with horses. Mr. Waite has but one team of animals, and these are worked practically all of the time on his farm, and were used but a short time last spring in removal work. With a view of still further increasing the business mailing cards are distributed, lots of 100,000 being sent out frequently.

Of his experience with motor vans Mr. Waite says that they have proven a real success. They have been worked for nearly three years in all manner of conditions and have made all kinds of hauls over roads of all kinds, from the best to very bad. The trucks have, he says, endured wonderfully well, and as a direct result from their use the haulage work of the business was in 1911 increased more than 50 per cent. over that of 1910, and in 1912 was again increased more than 50 per cent. over that done in 1911. This increase he attributes solely to the use of motor vans, for with them he can do work that would not be attempted with horses. In 1912 with five motor trucks more than double the work was accomplished than was done in 1910 with 20 horses, at a saving of 35 per cent. expense, and this year the result will be even more satisfactory because of the longer experience, the better contracts and the more work performed. While this gives the saving as 35 per cent. in contrast with horse work, this year there will be a much larger margin of profit because of the long distance contract work, which could not be undertaken with any other form of equipment, and this has been made more than ordinarily productive through securing return freights.

The Van Bodies of the Waite Trucks, Having Capacity of 784 Cubic Feet, with the Bonnet Affording Storage Space and the Wide Seats for the Crews of Five.

The value of this business cannot be estimated, but it is increasing constantly.

Mr. Waite does not maintain a garage, but keeps his machines in a public service station convenient to his warehouse, paying a flat rate for storage and washing and cleaning. The drivers formerly drove animals and have been trained in handling furniture. They are thoroughly experienced with the work and are capable, responsible men. These men are in charge of each job where they cannot communicate with the office and are expected to economize time and labor wherever possible, and at times the men and their helpers have long, hard trips. Mr. Waite says that a truck van can be driven 40 miles in less time than horses can be driven 20 miles, and will carry double the load. The vans are so large that not infrequently the furnishings of three apartments are carried in one machine, and where conditions will permit two and three jobs are done at practically the same time. The average load will weigh from two to three tons.

The drivers are not required to do work on the machines they drive, but a mechanic is employed who

is responsible for them and who is on call practically day and night. He inspects the machines as they are returned to the garage at night and he is expected to have them in readiness for service each morning. If necessary, he is given assistance in the work on the vans. When a machine is withdrawn for an overhaul the mechanic does the work and such parts as are necessary for restoration are ordered. Mr. Waite believes that this is the most economical form of maintenance for a fleet of the size of his. The records kept are of the mileage, the fuel, oil and grease used, the tire mileage and the cost and adjustments, and the expense of supplies, accessories and parts purchased. The mechanical work and the storage are covered by the wage of the mechanic, unless additional labor is provided, and the garage bill each month. To these charges is added the overhauling and painting.

RECEIVER FOR POPE COMPANY.

Early Maturing Note Issue and Condition of Market Lead to the Appointment.

Col. George Pope was appointed receiver of the Pope Manufacturing Company, Hartford, Conn., maker of Pope-Hartford cars and trucks, by Judge Joseph P. Tuttle of Hartford, Oct. 27. At ancillary proceedings in the United States District Court at Boston Oct. 28, Col. Pope was named as ancillary receiver. Col. Pope is treasurer of the company and has qualified as receiver under a bond of $200,000.

The condition of the automobile market and that the company has an issue of $1,000,000 two-year notes bearing interest at six per cent., which will mature April 1, 1914, led to the application for a receiver, the proceedings being of a purely friendly character. Reports of dissension between the Pope and Walker interests, which have controlled the company, are emphatically denied by President Albert L. Pope, who maintains that the interests of the Walkers and the Popes are identical and in every way harmonious.

The appointment of the receiver will make possible the continuance of the business under the orders of the court, and will prevent complication that might in any way hamper the business. The officials of the company confidently expect that the creditors will be paid in full and that the stockholders will either receive a substantial dividend or will be in a position to realize largely under a reorganization plan, should this be decided on. The authorized capital of the company is $6,500,000, and $3,690,800 common stock and $2,989,200 preferred stock have been issued, leaving 3092 shares of common stock and 2018 shares of preferred stock in the treasury. When the issue of notes was made it was to liquidate a floating indebtedness of about $250,000 and provide additional capital, and a part of the $750,000 was devoted to building an addition to the factory. Under a trust agreement the company has been required to maintain a surplus of $500,000 in quick assets over all indebtedness during the life of the note, and no mortgage could be placed on the property.

The company has a plant at Hartford, where cars and motor trucks are built, and has a bicycle and motorcycle factory at Westfield, Mass. The officers of the company are: Directors, Albert L. Pope, Hartford; George Pope, Hartford; Arthur W. Pope, Boston; Edward W. Pope, Boston; C. E. Walker, Hartford; W. C. Walker, Hartford; H. C. Wiley, Boston; F. A. Drury, Worcester, Mass.; R. M. Currier, Boston; president, Albert L. Pope; vice president, C. E. Walker; treasurer, George Pope; assistant treasurer, E. M. Cutting; secretary, W. C. Walker; assistant secretary, H. A. Lienhard. Col. Pope, the receiver, is a pioneer of the bicycle and automobile industries of the United States and he is treasurer of the Automobile Chamber of Commerce.

Fleet of Half-Ton Commerce Wagons in the Service of the Green-Joyce Company's Department Store at Columbus, O.

The branch of the Goodyear Tire & Rubber Company at Milwaukee, Wis., was recently destroyed by fire with a loss of $225,000. The company has established a temporary branch at 338-40 East Water street, a short distance from the former location.

R. V. Board of Boston has been elected president of the Kentucky Wagon Manufacturing Company, Louisville, Ky., builder of Urban electric wagons, and Philip S. Tuley of Louisville, Ky., is now vice president of the concern. W. C. Nones, formerly president of the company, has been elected chairman of the board of directors.

F. W. SMITH NEW EXECUTIVE OF E. V. A.

Chicago Convention Productive of Well Founded Plans for Promoting the Use of Electric Vehicles—Substantial Publicity Fund Insures Continuity of Campaign.

ENTHUSIASM and a decided spirit of co-operation were manifested at the fourth annual convention of the Electric Vehicle Association at Chicago, Oct. 27-28, and with the largest attendance in the history of the organization at a gathering of this character, the purpose of the officers and members, to systematically promote the use of electric vehicles, was carefully developed and plans for the coming year were matured. This was the first time the association convention had been held west of New York, and through the energetic endeavors of the committees and officers the showing of eastern members was surprisingly large, while the Chicago committee had aroused a very large degree of interest among western men.

Frank W. Smith, President of the Electric Vehicle Association of America.

One of the results of the convention was the opportunity for the different interests to reach definite levels on which the promotive work can be carried on, and to determine policies which would be equally productive for all. The membership was materially increased by the advent of a stronger western representation, and plans were made which will result in the establishment of several additional sections, which will greatly broaden the influence of the association. The organization has now a very substantial foothold in the east and the west, and with the activities of the membership constantly extending, and with concerted endeavors of members who fully understand the benefits to be secured, there is no doubt whatever that the association will be largely increased during the year.

During the convention 351 members were registered and upwards of 50 applications for membership were made, so that with 428 members of record prior to the convention the aggregate is well along toward the 500 mark, which is a growth on which the association may justly pride itself. The plans for the convention were developed by a committee that had abundant time for organization, and the results were in every way satisfying. The eastern delegation was assembled in New York, the New England contingent in part coming from Boston in a party, and left the Metropolis Oct. 26 in a special train under the direction of F. Nelson Carle as master of transportation. The delegates were joined at different points en route and reached Chicago Oct. 26. The headquarters were at the Hotel La Salle, where the convention was held in apartments on the 19th floor, and many of the manufacturers established themselves in rooms on the 18th floor, where small exhibits were made and where the members of firms or their representatives could meet friends and those connected with them in business transactions. The opening of individual headquarters made possible meetings that would have been at least doubtful under ordinary conditions, and was decidedly promotive of relations beneficial to all.

President Williams' Address.

The morning of the first day until 10 was devoted to registration and general preliminary work incidental to the formalities, and then the first session was called together by President Arthur Williams, who made the annual address of the executive. He congratulated the association on the growth made in three years, for it had increased from the 29 organizing members to 418 of record at the opening of the convention, including 34 manufacturers of electric vehicles and 61 central stations. He pointed out that the possibilities for expansion were very large, and that with the association larger than ever before, with precise and well directed activities, and with potent influences constantly exerted for promotion of the industry, the results ought to be very gratifying. The association has sections in New England and Chicago, and local associations in New York and Philadelphia, and live interests are projecting a section on the Pacific Coast.

Mr. Williams believed that the association ought eventually to include in its membership every company operating a central station, and there was a possibility of securing as members every user of an electric vehicle. The prospects for the growth of the electric vehicle industry were very encouraging. The number of manufacturers was now 37 as against 20 a year ago, including both pleasure car and service wagon builders. He pointed out that there were, as established by carefully compiled figures, 37,000 electric vehicles in the United States, and this number was increasing with gratifying rapidity. Turning to the possibilities of the electric, he stated that as about 85 per cent. of the transportation by highway was within the distance zones that made practical the use of such machines, he was extremely confident that the economy and endurance possible through their use would eventually result in their adoption by business men. The certainty of operation and economical maintenance made the electric ideal for fire apparatus and installations where quick starting was essential. He stated

that the heavy duty to which storage batteries could be subjected was well demonstrated by the operation of street cars in New York City, for transportation lines using them were required by demands of the public to afford constant and satisfactory service. The storage battery cars were absolutely dependable.

President Williams emphasized the necessity of attention by the association to the conditions of traffic in some of the large cities, especially New York, where the thoroughfares were so greatly congested during the day that the only practical solution appeared to be haulage by night, with the probable readjustment of transportation, so far as shipping and receiving was concerned, to meet the changed requirements. Were haulage carried on during the night this would eliminate much congestion, and would result in a very large saving of time, as well as reducing the number of vehicles needed. There would be enormously increased efficiency and by the use of electric vehicles the streets would be so much economized that there would be but little delay as compared with what is now experienced. The utilization of electric vehicles in city haulage service offered very extremely attractive possibilities, and the demand for current for vehicles would afford very large incomes for the companies supplying it. If all the haulage were done by electric vehicles in the large cities, only, and the price paid for current were but two cents a kilowatt-hour, the annual income to the central stations would approximate $400,000,000.


Day Baker, Re-Elected Treasurer of the Electric Vehicle Association.

The economic value of the land that is now devoted to raising food for animals was touched upon by Mr. Williams, who maintained that these tracts could be used for food crops, with the consequent reduction of prices and establishing absolutely dependable markets. No loss would be experienced, but there would be a changed condition that would decidedly benefit the people. There was no doubt that the evolution of transportation would mean the adoption of mechanical vehicles and a very large part of these would be electric. The standardization of certain equipment, in the opinion of Mr. Williams, was very important, and should be brought about. He believed that the endeavors of the committee in charge of the publicity and advertising deserved the hearty commendation of every member, and maintained that the promotive campaign planned would be productive of very large returns. One of the essentials for the development of the electric vehicle industry and the promotion of the use of machines was the practical garage, where service could be obtained, and in proportion to the number of those stations, and dependent upon the attention that could be obtained, would be the use of electric machines. What would undoubtedly have a material influence in the sale and use of machines was within the scope of the organization to deal with, and this was the publication of books that would contain maps and reliable information and the location of the different stations where charging could be obtained and repairs be made.

At the conclusion of the paper it was referred to a committee consisting of W. P. Kennedy of New York, E. E. Witherby of Chicago and Hayden Eames of Cleveland, O.

Reports of Committees.

The reports of committees were then received. In the absence of Chairman P. D. Wagoner the report for the legislation committee was made by E. W. Curtis, Jr., of New York, and this pointed out the inclination of legislators to enact more or less radical laws, generally unduly penalizing or taxing the owners of motor vehicles. The efforts of the organizations of motor vehicle owners in opposing objectionable legislation were considered, and the committee pointed out that a New York legislative committee is to confer with commissioners representing nine different states, and eventually with the federal government, with the hope of formulating law that will serve the interests of the public without restricting the utility and economy of the motor vehicle. Standardized laws were to be recommended. The committee was purposed to afford such assistance in formulation of laws as might be necessary, and urged the necessity of opposing unreasonable restrictive legislation.

Chairman W. P. Kennedy made report for the committee on operating records, which was in the form of a tabulation of operating cost that might be submitted as definite and dependable information whenever needed, covering seven sizes of vehicles from 750 to 10,000 pounds, and applicable as average expense. The committee also submitted a general form for recording such operating cost. No specific rate of current cost was specified because of the variance in different localities, but it was stated that the average would be about four cents a kilowatt-hour. As the cost of current is seldom more than 10 per cent. of the operating cost the rate for current was not regarded as of more importance than other factors. The report was discussed by S. G. Thompson of Newark, N. J.; J. S. Codman of Boston, George H. Jones of Chicago, C. F. Smith of Boston, W. H. Conant of Washington, Day Baker of Boston, J. A. Hunnewell of Lowell, E. S. Mansfield of Boston, F. Nelson Carle of New York and Charles H. Marsh of Washington.

For the committee on insurance Chairman Day Baker made report that the committee had secured a 10 per cent. differential rate on electric vehicles that

had been almost universally adopted, and that the committee had further secured from the New England Casualty Company a reduction equivalent to 10 per cent. from the rate first obtained, or practically 20 per cent. from the standard rate for gasoline vehicles and trucks. In the consideration of this report the value of the advertising and of the insurance differential was emphasized by President Williams and Converse D. Marsh of New York.

Harvey Robinson, Re-Elected Secretary of the Electric Vehicle Association.

Favor Education in Schools.

Charles Blizard of Philadelphia presented the report for the committee on the courses of instruction in electric vehicle practise, in the absence of Chairman W. G. Pancoast, which was inaugurated in the West Technical high school of Cleveland, O., the report describing the course in that institution. The educational work undertaken by the Denver Gas and Electric Light Company of Denver was stated by E. M. Jackson of Denver, and he believed a course of vehicle and battery instruction could be promoted by the association. E. E. Witherby of Chicago proposed that a correspondence school be established by the association. E. W. Curtis, Jr., told of the school established by the General Vehicle Company, and Day Baker stated that the technical schools of Boston have begun consideration of the advisability of such a course. The investigation made by the Chicago section was told of by Homer E. Neisz of Chicago.

John F. Gilchrist of Chicago made report for the committee on rates and charging stations, which had obtained data from 128 different central stations. It was shown that the average rate in 91 of the largest cities was 3.007 cents a kilowatt-hour for current supplied to public garages and 5.338 cents a kilowatt-hour for current supplied to private garages. The service inaugurated by the Hartford Electric Light Company, which is practically a battery exchange, the owner purchasing a vehicle without a battery and paying a stated price for the battery mileage used, being relieved from all maintenance, was described. The committee expressed itself as being much interested in the commercial result of the service. The report was discussed at considerable length.

President Williams named as a nominating committee George H. Jones of Chicago, E. W. Curtis, Jr., R. L. Lloyd of Philadelphia, E. S. Mansfield of Boston and Charles Blizard of Philadelphia.

Papers and Discussions.

At the opening of the afternoon session reports were made under the subject "What the Sections Are Doing", by Homer E. Neisz of Chicago, J. A. Hunnewell of Lowell for the New England Section, Harvey Robinson for the New York Electric Vehicle Association and Day Baker for the Electric Motor Car Club of Boston.

"Co-Operation Between the Electric Vehicle Manufacturers and the Central Stations" was the subject of a paper by E. L. Callahan, vice president of the commercial section of the National Electric Light Association, who contrasted the results to be obtained by the electric vehicle manufacturer and the central station from the promotion of the use of electric cars and wagons. He maintained that the manufacturer benefits by the better satisfaction of vehicle users, the improvement of operating conditions, the use of more machines and the advice as to prospective purchasers, while the central station benefits from increase of revenue, the advertising from the use of the vehicles and the general social and industrial progress of the community. He was of the opinion that the charging rates prevailing in most cities were reasonable, and pointed out that recently in a city of 325,000 people the vehicle charging rate was established as 3.8 cents a kilowatt-hour for the first 1000 and was reduced by a sliding scale for subsequent consumption. Investigation has shown that the cost of charging current was seldom 10 per cent. of the operating cost. He maintained that the revenue from an electric flat iron equalled the original sale price in about 4.5 months, while the revenue from a vehicle was about six per cent. of its cost annually.

The paper was discussed by Converse D. Marsh and S. G. Thompson of Newark, N. J., who insisted that the central stations should at least share the expense of vehicle selling, as the average revenue was about 300 per cent. of the cost of securing the business. Day Baker called attention to a "Handbook of Electric Vehicles", written by F. S. Smith and H. C. Cushing, Jr., of New York, as containing valuable data and information. H. H. Rice of Indianapolis was of the opinion that the possibilities of profit to the central station should be explained by the vehicle manufacturers to secure co-operation. He maintained that the neglect of the electric machine in the garage, rather than its use on the streets, was the most general cause of dissatisfaction.

A decidedly interesting paper on "The Merchant, the Central Station and the Electric Truck" was read by F. Nelson Carle, advertising manager of the General Vehicle Company. He maintained that the central station was a potent educational and industrial influence in the community, in which the people had confidence, and it was a logical advocate for the electric machine, and for this reason it is asked to assist in promoting, through advertising and other publicity, its use. The reason for asking this was that by central station aid the first cost of distribuiton would be

reduced and the expense brought where it would promote rather than restrict production. He emphasized the prestige of the central station in the community, the fact that it has minimum advertising rates, that its publicity is interesting and productive of confidence, and that its good will can be a great factor in the sale of electrics. He believed the greatest single educational force behind the electric vehicle to be the Electric Vehicle Association, and next to this rated the work now being done by the central stations in a number of the large cities.

"Traffic Problems and the Automobile" was the title of a paper read by Dr. E. E. Pratt, manager of the industrial bureau of the Merchants' Association of New York City, which was a very careful summary of the conditions obtaining in New York, which can be applied very generally to other large cities, with suggestions for remedies that might be desirable. He maintained that while there could be regulation of the street traffic, the congestion at freight terminals could not be reduced until a system could be developed that would make possible the delivery of freight at the terminal nearest the consignee. The physical terminal should be so developed as to give the truck of the consignee rapid and efficient service. He believed that the solution would be best made by a commission of experts appointed by the city or state which would be charged with studying, first, the sources of accidents arising from automobiles; second, the wear of the street surfaces due to automobile traffic, and, third, the whole subject of traffic delays on streets and at terminals and docks.

Adjusting Garaging Rates.

The third session was opened the morning of the second day by the presentation of the report of the garage committee, which had been appointed to investigate conditions and attempt to arrange local rates for the charging and care of electric vehicles throughout the country, and which had appointed local committees to make investigation and recommendation, the reports of which were included. The committee had proposed that manufacturers of vehicles and parts cooperate with the committee by offering public garages repair parts at such discount as would make possible the sale of parts at the same prices as sold by the manufacturers' agents, and permit a reasonable margin of profit, but this had been found impracticable with many because of the agency agreements. This paper was followed by discussion on the subject of discount for repair parts.

David F. Tobias of the United Light and Power Company, New York City, read a paper on "The Electric Vehicle in Department Store Service" in which the installation of Gimbel Brothers in New York City was described at length and the efficiency of the service was considered. C. A. Duerr, manager of the Gimbel Brothers garages, told of the satisfaction obtaining with electrics and stated that with an experience of three years there was no doubt the electric vehicles were both practical and economical.

S. C. Harris of New York read a statement relative to vehicle batteries that had been made to another association, in which care of batteries was generally considered.

M. R. Barry of the Electric Products Company, Cleveland, O., presented a very interesting paper on "Charging Storage Batteries in Unattended Garages". This was followed by a paper on "Electric Vehicle Salesmanship", a consideration of the possibilities of well organized selling campaigns, by George H. Kelly and E. J. Bartlett of the Baker Motor Vehicle Company, with suggestions for co-operative promotion by the vehicle manufacturer and the central station. A paper of unusual interest on "Recent Developments in the Lead Battery for Electric Vehicles" was read by Bruce Ford of the Electric Storage Battery Company.

Frank W. Smith Elected President.

The election of officers resulted in the unanimous choice of the recommendation of the nominating committee, which was as follows: President, Frank W. Smith, United Electric Light and Power Company, New York City; vice president, John F. Gilchrist, Commonwealth Edison Company, Chicago; secretary, Harvey Robinson, New York Edison Company, New York City; treasurer, Day Baker, General Vehicle Company, Boston; directors, Arthur Williams, New York Edison Company, New York City; William P. Kennedy, New York City; William G. Bee, Edison Storage Battery Company, Orange, N. J.; Clare N. Stannard, Denver Gas and Electric Light Company, Denver, Col.

The Closing Session.

The afternoon session of the second day was devoted to the reading of a paper on "Electric Commercial Vehicle Tires" by F. E. Whitney of the Commercial Truck Company of America, which subject aroused keen interest, and to the presentation of the report of the publicity and advertising committee, which was read by President-elect Smith, the chairman. The result of the first year's promotive campaign was briefly reviewed, and the statement made that it had been productive of about 2000 direct replies to advertising, aside from the other promotion. The campaign of the Society for Electric Development conflicted with the collection of funds for advertising, but with few exceptions all the larger central stations renewed their subscriptions. At the time the report was compiled the number of subscribers totalled 107, an increase of five as compared with the previous year, and the amount of subscriptions was $34,046.38, received from 82 central stations, 10 battery and accessory manufacturers and 15 vehicle builders.

Of the subscriptions 54 per cent. came from central stations, 31 per cent. from battery and accessory manufacturers, and 15 per cent. from vehicle builders. Of the first year contributors 39, including five vehicle manufacturers, have not thus far contributed, so that the list for the 1913-14 campaign contains 47 names that are new. Most of these are central stations.

The plan for the second year involves an expendi-

ture of $33,422.28, which will be carried on through general magazines, fashion and social publications, central station prints, automobile trade journals and a fifth group of three specialized mediums. The estimate includes the publication of two booklets, "The Story of the Electric Pleasure Vehicle" and "The Story of the Electric Commercial Vehicle", which illustrate the productions of the manufacturers who are contributors to the fund. The booklets will be distributed in response to inquiries, and can be utilized by central stations as part of their advertising literature at comparatively small expense. The detail of the general plan of the campaign was included in the report.

The session was closed with a talk by Ralph Temple of the Temple garage, Chicago, whose subject was, "How to Make the Business Healthy".

The evening of the first day a beefsteak dinner was served to the delegates at 6 o'clock, and the early part of the evening was given over to an automobile tour of the various electric garages of the South Side and to several department store garages, after which there was a supper and a cabaret entertainment at the Hotel La Salle. The members were entertained at luncheon the second day by the Commonwealth Edison Company. An invitation was received through R. L. Lloyd of the Philadelphia Electric Company for the association to convene at Philadelphia in 1914.

Plans comprehending the erection of a large service station in New York City are under consideration by the officials of the General Motors Truck Company, and if these are realized the intention is to erect and equip a building in a central location that will have every facility and convenience for business men who would desire to maintain fleets of machines but would not care to establish garages. The building, if the plans fructify, will be the headquarters of the business of the company in the Metropolis and suburbs.

Economy and efficiency tests will be conducted in connection with the truck show to be held at Los Angeles, Cal., the week of Nov. 17 in the exposition hall, under the management of Walter Hempel. As 70 makes of service vehicles are sold in southern California, and this will be the first show for the Pacific Coast, it is expected that the display will be very large.

The Signal Motor Truck Company of New York will manufacture a light delivery wagon and has established a factory in a building at 672-4 Commonwealth avenue, Detroit, Mich., which has been leased for five years.

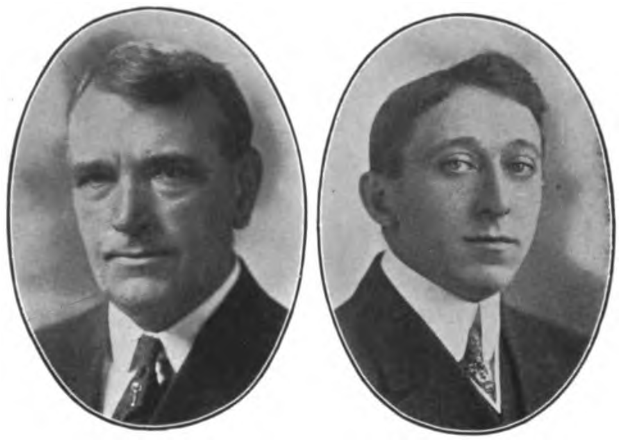
The annual convention of the sales organization of the Firestone Tire & Rubber Company was held at Akron, O., Oct. 7-10 inclusive and was attended by more than 200 branch managers, salesmen and representatives.

MAKE KELLY TRUCKS.

Two Men Who Have Succeeded Well in the Country of Their Adoption.

Two men who are largely responsible for the success of the Kelly-Springfield Motor Truck Company, Springfield, O., maker of Kelly trucks, are President James L. Geddes and Chief Engineer Charles Balough. The former was born on a farm near Banffshire, Scotland, March 16, 1857, and the latter in Nagy-Lak, Hungary, in 1883.

Mr. Geddes secured his education in the schools of Aberdeen, and came to this country in 1874. Later he became connected with the Grand Trunk railroad, and when he left that concern in 1899 he was auditor of the car department for the entire Grand Trunk system, with headquarters in Montreal. He next became general manager of the Detroit City Gas Company, with title of auditor, and later was its treasurer. This company is controlled by the Emerson McMillan Company, 40 Wall street, New York City, which has varied



At Left, President James L. Geddes; at Right, Chief Engineer Charles Balough, Kelly-Springfield Motor Truck Company.

interests throughout the country, and Mr. Geddes represented it in several capacities. He became president of the Kelly-Springfield company in April.

Mr. Balough was educated in Budapest, and in 1902 was graduated from the Royal St. Joseph University with the degree of mechanical engineer. He came to America in 1903, since which time he has been connected with the engineering department of the following concerns: Northern Motor Car Company, Great Lake Engineering Works, Ford Motor Company, Cadillac Motor Car Company and General Motors Company. He was appointed chief engineer of the Kelly-Springfield company in July, 1910.

Robert N. Barker has assumed charge of the advertising department of the Palmer-Moore Company, Syracuse, N. Y., having resigned a similar position with the Chase Motor Truck Company of Syracuse after a service of two years. Mr. Barker was formerly identified with several advertising agencies in New York City.

THE G. V. 1000-POUND WORM DRIVEN WAGON.

THE General Vehicle Company, Long Island City, N. Y., maker of the well known General Vehicle electric wagons and trucks, has just placed in the market a 1000-pound worm driven wagon that is a distinct creation in that it differs broadly from anything this company has yet turned out, but it conforms to the general appearance of motor wagons. The machine is lower and longer than any previous type built by this company, and instead of the battery being carried in a cradle under the body it is installed forward of the dash and is protected by a long sloping hood. The driver's seat is behind the dash, and this increases the length of the vehicle considerably as compared with machines with underslung batteries.

This design will be built in the 1000-pound size only, and it is intended that it will meet the favor of those who approve the vehicle that in a general way suggests and resembles the pleasure type of machine rather than that which more closely resembles the wagon. This appearance is considered desirable for light store delivery equipment, and while it is less economical of space in street and garage, the somewhat lower load centre of gravity is offset by the installation of the battery on the chassis instead of under it. The wagon has the same loading space, 72 inches length, 41 inches width and 60 inches height, of the other 1000-pound type, which has been found sufficient for all ordinary merchandise.

The New 1000-Pound General Vehicle Wagon—A Worm Driven Chassis with a Standard Panel Body.

The wheelbase has been lengthened to 108 inches, an increase of 1.5 inches, but the frame is narrower, this increasing the swing of the forward wheels and minimizing the turning radius. The tread is 58 inches. The approximate length of the wagon is 168 inches and the extreme width 65 inches, the body platform being 30 inches above the ground. The frame is a pressed steel channel four inches width, and this is carried on semi-elliptic springs, 46 inches length forward and 54 inches length rear. The front axle is a drop forged I section and the rear axle is a full floating construction. The steering gear is a semi-irreversible type with raked steering column and a large hand wheel. The tiebar, drag link and tail lever are all of ample proportion. The service brake is operated within and the emergency brake is operated without steel drums 15 inches diameter and with faces 2.5 inches width bolted to the rear wheels. The brake shoes and bands are faced with anti-friction material, not affected by water, oil or heat. The service and emergency brakes are controlled by pedals.

The wagon is driven by a single General Electric series wound motor, and the power is transmitted by a shaft with a universal joint at either end to the worm shaft and worm wheel mounted in the steel rear axle housing. The worm shaft is steel and the gear wheel, with which is assembled the differential, is of bronze, so that there is practically no possibility of noise. The differential assembly and the wheels are mounted on Timken roller bearings. The construction is with special reference to endurance, and there should be little wear even with extreme mileage. The battery and motor will give 45 to 65 miles on a single charge at a speed of 12 miles an hour, and at 15 miles an hour a mileage of 40 to 50 miles, this meaning driving on hard, level roads and loaded to its rated capacity for half the distance, or carrying half capacity the full distance.

Great care has been taken to protect the wiring, and even the bell and lamp circuits are enclosed in rigid metal conduits. The controller is a continuous torque type, affording four forward speeds and two in reverse, and this is installed beneath the seat in a metal box. The three-way type running switch is under the driver's seat in a sheet metal box, and the handle of the controller can only be removed when it is in a neutral position. The machine is unusually well protected, the application of either brake cutting off the power in the event the controller handle has not been turned, and the emergency brake cannot be locked save when the running switch is in the neutral or charging positions, and it cannot be released until the switch has been turned to the "running" position. The running switch can only be turned to the running position when the controller is in neutral. The controller "throw-off" in an emergency allows the driver the use of both hands on the steering wheel and both feet on the brake pedals. The "emergency brake lock"

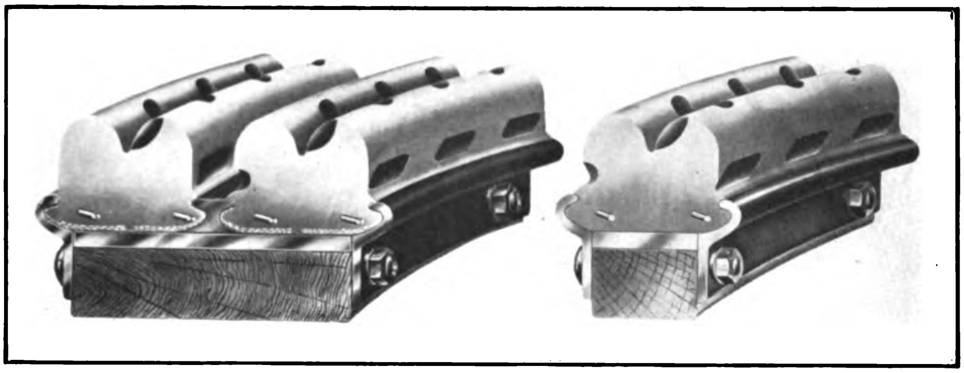
necessitates the driver turning the running switch when leaving the wagon standing, and the removal of the switch handle prevents the wagon being removed. The brake cannot be released until the switch handle is replaced and turned. Accidental starting is prevented by the running switch lock, such as might happen if the controller had been tampered with during the absence of the driver and he threw on the running switch without noting the position of the controller.

The chassis has been supplied with every convenience for economizing labor and the wheels are fitted with demountable rims. The tires are 36 by three inches. The chassis is sold with the hood, mudguards, running boards, bell, hub odometer, tail and dash lamps, kit of tools, and charging plug with 12 feet of cable. This machine was shown for the first time at the recent Electrical and Motor Vehicle Show at Grand Central Palace.

NEW MOTZ TIRE FOR TRUCKS.

Service Wagon Equipment Developed from Pleasure Vehicle Experience.

The Motz Tire & Rubber Company, Akron, O., which has for a number of years specialized a solid rubber tire in which cells afforded greater resiliency, and which was designed for pleasure vehicles exclusively, has begun the production of shoes which are intended for service wagon equipment. The Motz tire has been claimed by the maker to be built from a compound that has unusual endurance and is maintained to be resilient in a degree peculiar to itself, the combination of material and design affording a shoe that has been found to be especially efficient, particularly with electric machines, where current economy is an extremely important factor.



The New Motz Wagon and Truck Tire: A, the Dual Equipment for Rear Wheels; B, the Single Shoe for Front Wheels or Light Wagons.

The company had demand for equipment that could be used on service vehicles, and experiment was begun to develop tire design that would endure the hard work and at the same time have the qualities that had been characteristic of the pleasure car equipment. The experimentation has resulted in the production of shoes that are claimed to have all the resiliency and endurance that are realized from the original design, and to have as well all the practical qualifications that are desired for wagon and truck service. These statements are based on use for several years on machines in actual service.

The tires are made single for forward wheels and light vehicles, and duel for rear wheels and heavy machines. The slanting or diagonal cellular side construction insures high elasticity, while about the inner side of the tread are vertical cells that effectually resist skidding. The claim is made that these cells will endure and will be effective during the entire life of the tire, which is guaranteed for 10,000 miles in one year, this guarantee covering defective material or faulty workmanship, provided the vehicle is used in accordance with conditions based on the capacity of the machine.

The tire has double the tractive area of the ordinary solid tire of the same rated size. This is regarded as an important factor, involving a great saving in fuel consumption, and consequent economy of operation. That is, the tractive effort of the machine is always productive.

ELECTRIC VEHICLE HANDBOOK.

The "Electric Vehicle Handbook" is the title of a volume published by H. C. Cushing, Jr., and written by Mr. Cushing and Frank W. Smith, vice president of the Electric Vehicle Association of America, which has just been issued. Mr. Cushing is publisher of a well known electrical magazine and Mr. Smith is vice president of the United Electric Light & Power Company of New York City. The book is of convenient pocket size and has 354 pages of text, and has a flexible cloth binding. The book is intended to be a source of information on the fundamentals of the operation, care and maintenance of electric vehicles, the batteries, motors, controllers and accessories, and following a preliminary article on electric vehicle development by William P. Kennedy the chapters deal with lead storage batteries, the care of lead storage batteries, commercial types of lead storage batteries, alkaline storage batteries, charging apparatus, charging stations, measuring instruments, wheels, motors, controllers, chassis and comparative cost data. Each subject is treated in a non-technical manner and sufficient explanation is made so that a reader may comprehend logically the detail.

The "Electric Vehicle Handbook" contains numerous tables, wiring diagrams and other data that are desirable for ready reference. The work is creditable in every way and will be found useful by all who desire this character of information.

THE FUEL QUESTION AS SEEN ABROAD.

Careful Investigation by British Engineers Develops Interesting Results with Substitutes for Gasoline—Regarded as an International Problem.

THE subject of internal combustion engine fuel has been given material attention in America for several years, more because of the increase of the cost than from any fear of shortage, but in Europe, where the price of gasoline is much more than in this country, and where taxes are often imposed, and there are rigidly enforced restrictions of its use, all manufacturers and users of motors have given both the supply and the cost a marked degree of careful consideration. It is but natural that those who have to do with the production of motors and motor vehicles should begin systematic investigation, and large amounts have been offered as prizes to stimulate research, with the purpose of developing a substitute fuel and for methods of vaporization that will afford satisfactory operation of motors that are now in service.

There are millions of motors in use that were designed for operation with a fuel that may be gasoline or what closely approximates its qualities, and it is natural that those possessing such engines should desire by perfected carburetion to continue their use with a less expensive fuel. Not only this, no manufacturer of internal combustion engines cares to turn to producing other types of motors when there is such uncertainty as to the fuels, and no positive knowledge that this is necessary. As a matter of fact the building of gasoline motors has been continued for years despite the increased cost, and the supposition is that gasoline will be used for years to come.

The Institution of Automobile Engineers, which is the British national organization of automobile engineers, designers and builders, has made a special study of fuels, and at the first meeting of the season, held Oct. 8, at the Institution of Mechanical Engineers in London, the new president of that body, J. S. Critchley, dealt with the fuel question in a broad way, and considered it from an international viewpoint rather than from that of the organization of which he is the executive. As his views were applied to the possibilities of the development of the service wagon and truck, and were based on accurate knowledge, they were especially interesting. Some pertinent extracts from his address were as follows:

The demand for motor fuel derived from petroleum, apart from the petrol required for automobiles, is increasing at a very rapid rate, with a corresponding increase in price, and the automobile engineer must seriously consider what are the future prospects of obtaining a fuel suitable for the internal combustion motor at a price which will not impede the development of the industry. The cost of petrol has steadily risen until it now commands a price which, without doubt, seriously handicaps the development of the commercial vehicle. The automobile motor is a type of engine in which economy has of necessity been sacrificed in the desire for small size and weight. For example, the indicated thermal efficiency of a first class motor engine is approximately 28 per cent., while the brake thermal efficiency is about 22 per cent., whereas in tests of gas engines a brake efficiency of 26.7 per cent is obtained with an engine of five horsepower, 28.3 per cent. with a 30 horsepower engine, and 30 per cent. with a 60 horsepower engine.

Petrol is today about the most expensive fuel that can be employed commercially for power production. Taking its cost at 20 pence per gallon, approximately 7000 B.Th.U. will be obtained for one penny, and allowing for the loss in motor efficiency and the transmission losses, only about 1500 B.Th.U. for one penny remain, while crude oil at 3½d per gallon would give some 40,000 B.Th.U. for the penny, coal at 18s. per ton would give about 62,000, and coal gas at 2s. 6d. per 1000 cubic feet some 23,000 B.Th.U. With petrol at its present prevailing price it is obvious that the automobile cannot be compared in economy with other types of motors in which a cheaper fuel is employed.

In view of the enormous increase in the demand for petroleum spirit and petroleum products generally, and the consequent rise in ocean freights, there does not appear to be any prospect of a reduction in the price of fuel unless a new source of supply can be obtained.

Production and Demand in America.

The seriousness of the matter is emphasized by a short review of the situation in the United States, which clearly demonstrates that the self-propelled vehicle can no longer depend entirely upon the grade of motor fuel which it is now using, and that there will have to be a considerable increase in the specific gravity of the fuel employed in that country, where the advent of the self-propelled vehicle has changed the whole aspect of the oil industry.

The price of petrol on the west coast of America is now 15 pence per gallon.

In the United States it is computed that there are about 1,000,000 cars registered, or approximately one car to every 100 inhabitants. If the proportion were as large in this country the price of fuel would surely rise to still higher prices.

Professor Magruder of Ohio State University calculates that in addition to the motor car engines there are 1,000,000 motors used for farm work and motor boats, and that taking the average horsepower of car motors at 25 and that of other motors at 10, 35,000,000 horsepower of gasoline engines are available for the practical generation of power. He assumes that each motor uses a maximum at rated load of .75 pound, or one pint, of gasoline per horsepower per hour, and that the total requirements of gasoline would be approximately 4,500,000 gallons per hour. The total annual supply of gasoline in America is estimated at 1,500,000,000 gallons, which would last only 333 hours. If, therefore, every gasoline motor were run at its rated load each day the annual distillation of gasoline would only permit them to be operated for about one hour per day or 333 hours per year. In other words, the present supply of gasoline is sufficient to operate continuously at their rated load only five per cent. of the gasoline engines now sold and in operation.

Fuel Consumption in Great Britain.

In Great Britain the estimated amount of petrol which will be consumed during the current year is 100,000,000 gallons. The total registration of vehicles in Great Britain in 1912 was 188,874, showing an increase of 28,982 over the preceding year. A considerable number of registrations are cancelled, but I think it would be safe to assume that 110,000 motor vehicles are in use. The 'buses and taxicabs of London number about 10,000 vehicles, and will consume approximately 20,000,000 gallons, while motor boats, motorcycles and other users will absorb at least another 10,000,000 gallons, so that for 100,000 vehicles we have some 70,000,000 gallons of petrol consumed.

Assuming that the average horsepower of each vehicle is 20, and that the petrol consumed is .75 pint per horsepower per hour, the 70,000,000 gallons spread over the resultant horsepower hours would only provide for the running of the vehicles 373 hours per year, which is little over one hour per day for every day in the year.

When it is considered that commercial vehicles must run at least three times as many hours as pleasure cars, it will be realized how great the increase in the demand for motor fuel must be with the increasing output and more general use of commercial vehicles.

In face of the increasing number of cars being put into service in the United States, and the enormous requirements for fuel in that country, it is more than evident that we can rely only on short supplies from that source. In the States new methods of distilling are being brought into operation, and natural gas is being liquified in order to increase the supply, 1000 cubic feet of gas giving two to three gallons of petrol.

Low Operating Cost Needed.

Progress in the use of commercial vehicles can only be brought about by low operating cost. For many trades even the wholesale price of 12d per gallon is a serious objection to the use of petrol. At one time the stumbling block in the way of the commercial vehicle was the high cost of rubber tires. Today any compensation obtained by the reduced cost of tires is wiped out by the increased cost of fuel. In the London cab trade, where a maximum fare of 8d per mile only can be charged, the increased price of petrol entirely wipes out any small profit which was made when petrol was at 7½d per gallon.

The rise in the price of petrol which came into force in January of this year, represents £19 per cab per annum extra working cost assuming that each cab consumes 1000 gallons of fuel per annum. With London's fleet of 7000 cabs the whole extra burden over last year is no less than £133,000, which represents five per cent. on a capital of £2,660,000. If the London General Omnibus Company were subjected to the same rise on a consumption of 12,000,000 gallons the increased cost would be £225,000 per annum. Even with the lowest priced petrol at 12d per gallon when taken in large quantities, the cost of fuel for commercial vehicles is at least 15 per cent. of the total charges.

Consider for a moment what one penny per gallon means to a company such as the London General Omnibus Company, whose consumption exceeds 12,000,000 gallons per annum. It represents a sum of at least £50,000 per year. While a private owner may be prepared to pay the high prices (and it must not be forgotten that the cost of distribution is about 4½d per gallon), the increased cost of petrol is a comparatively small item in the yearly motoring expenses. In the case of commercial vehicles the fuel item may be one which makes the use of motors unprofitable, and in view of the fact that the commercial vehicle has in various applications proved its economy and utility, cheaper fuel must and will be obtained.

Heavy Oil Motors.

The demand for crude oil fuel also is increasing with the demand for petrol, and this fact may be the means of large extensions in oil fields which will help to maintain the supply of petrol, for the reason that other grades of the production can be sold at a profit. The employment of crude oil for motors, ships, etc., where economy is the first consideration, is to a large extent regulated by the price of coal. If the cost of working oil engines advances beyond the figure comparable with that of steam driven engines, internal combustion engines will not be utilized.

A few years ago it was not thought possible to construct a heavy oil engine on the two-cycle principle and reversible, nor was it believed that such motors would be as economical and reliable as four-cycle irreversible engines, yet no sooner had the Diesel engine patents expired and the door been opened for experiment, than discoveries were made which at once placed the heavy oil motor in the very front rank as a prime mover for ships of large power, and provided the cost of fuel does not increase beyond a certain point such motors will supplant steam engines for that particular purpose, and also for other kinds of work.

Year by year the specific gravity of petrol and petroleum fuels has increased. The petrol of last century had a specific gravity of .680, and every car owner who had any self-respect used to carry a densimeter. Gradually, owing to the increased demand, the gravity has been increased until we now often use fuel of a gravity of .760. The densimeter is no longer necessary, as the modern carburetor accommodates itself to a very varying range of gravities. The gravity of a fuel is not so important as the boiling point, and a high gravity fuel with a comparatively low boiling point will function better than a low gravity fuel with a high boiling point.

It really does appear that it will be necessary to consider for commercial vehicles the use of kerosene, or a mixture having a still higher gravity than the fuel now employed.

Factors in Carburetion.

The carburetor for an automobile must fulfill the following conditions: The combustion must be perfect to a degree that there shall not be any offensive odor or visible exhaust; the fuel must be regulated to respond instantaneously to changes due to varying speed and load, and the combustion of the fuel must not deposit carbon or any other substance within the cylinder. In addition to its lack of volatility, kerosene has a smaller range of combustible mixtures with air than petrol, and greater viscosity, and it is much more difficult to obtain the proper physical conditions for combustion than in the case of volatile liquids and gases. It is, indeed, difficult to fulfill the requirements with kerosene carburetors as we know them today, and I do not think we are yet able to come to a conclusive opinion as to the best method of dealing with this fluid. The provision of an apparatus for kerosene which will give uniformity of temperature and complete vaporization before the mixture enters the combustion chamber is practically impossible with a motor which is subjected to such varying speeds and loads as the present day motor engine, and while heated carburetors such as the Stewart Morris, Standard, G. S., and many others which give more or less satisfactory results, I do not consider that anything approaching finality has been reached in connection with the method and means of dealing with this fluid, and now that real necessity has arisen not only in this, but every other country, for reducing fuel cost, I feel certain that improved methods will be found for bringing into use a fuel which contains, as far as its constituents are concerned, all that is necessary. One of the difficulties with the heated paraffin carburetor is to keep the temperature constant. There is, of course, one correct temperature at which a properly vaporized explosive mixture can be obtained, and this depends upon the boiling point of the fuel employed. To insure proper combustion it is necessary to maintain the temperature up to the point of firing. Condensation causes in the first place a weak mixture, while an accumulation of the condensed paraffin gives too rich a mixture. In both cases a foul exhaust is the result, in addition to a bumpy engine.

The Secor Engine.

Professor Hutton has shown that the only difference between an internal combustion engine using kerosene oil and the gas engine proper is that the oil engine requires a device whereby the liquid fuel may be pulverized so as to be introduced into the mixture in a state of such division that the liquid fuel, in a condition analogous to a mist, shall be distributed all through the mixture of oil and air so that the propagation of flame shall be instantaneous, or practically so, as it is in a mixture of air and gas. Speaking of the Secor engine, he describes it as an "American design in which the external vaporizer is discarded, and in which the liquid oil is drawn in at atmospheric pressure with the necessary air by the aspirating or charging stroke of the piston. The proportion of liquid to air is determined by a micrometric adjustment of the inlet valve controlled by the governor. The lack of precision incident to a forced oil supply and an inhaled air current is thus avoided." The Secor system employs a multiple unit governor which regulates the fuel proportions—weak mixtures for high compressions and strong mixtures for low; the quantity of fuel mixture; the internal temperature during compression by means of the addition of finely atomized water to the mixture; the ignition timing and the use of petrol for starting.

The Bellem Motor.

The Bellem engine which is being tested by several firms in France employs neither carburetor nor compressed air ignition. This engine can be started cold, and will run not only with kerosene, but also with crude oil. The characteristic feature is a complete pulverization of its fuel in a partial vacuum. The engine is provided with mechanically operated inlet and exhaust valves; the inlet valve, however, admits only pure air, and does not open until 30 degrees before the lower dead centre, closing 30 degrees later. The fuel is admitted through a separate automatic valve into the rarified atmosphere of the cylinders. Experiments have shown that if the atomizer is used in a chamber at atmospheric pressure with compressed air passing through the valve, a certain condensation takes place.

Tests of a single-cylinder engine of this type have been made in the laboratory of the Automobile Club of France with the following results:

Revs. per minute	Brake H. P.	Gallons per H. P. Hour
820.0	5.2	
813.0	5.1	0.125 fuel, kerosene
811.5	5.0	
811.7	5.0	0.258 fuel, alcohol
773.0	5.1	
760.0	4.3	0.111 fuel, crude oil

The cylinder dimensions were 100 mm bore by 150 mm stroke, the compression with petroleum fuel was 73 pounds per square inch, with alcohol, 96 pounds per square inch, and with crude oil, 80 pounds per square inch. The specific gravities of the fuels used were:

Petroleum	0.810
Alcohol	0.834
Crude oil	0.885

Southey Kerosene Carburetor.

Another notable departure in the utilization of kerosene is the Southey carburetor, which does not depend upon vaporization by heat from the exhaust. The system adopted is similar to that of a suction gas plant; the fuel is, in the first instance, combined with oxygen to a less degree than that required for complete combustion, and additional oxygen is given to the charge in its flow to the cylinders. It is claimed by the inventor that the charge is a fixed gas and that therefore there is no loss by condensation, and if necessary the charge could be carried in pipes as with coal gas. With this carburetor it is possible to start cold, the initial explosion being produced by means of a double-pole sparking plug which is only used for a short period, as when once started there is a constant flame which automatically furnishes the required heat.

In a recent test, kerosene at 6¾d per gallon was the fuel employed, and the consumption was stated to be equal to that of petrol with an efficiency of 49.8 ton-miles per gallon. This vaporization system is being employed by Commercial Cars, Ltd.

Mixing Kerosene and Petrol.

Many users of commercial vehicles are employing a mixture of kerosene and petrol in a proportion of about two of petrol to one of kerosene. This points to the fact that the present day carburetors can deal with a fuel of even greater specific gravity than the lowest grade petrol, and it would appear that certain qualities of naphtha and kerosene might be consistently used. I have recently been operating some vehicles with a fuel of a specific gravity of 0.79, and have overcome the starting difficulty by the injection of small quantities of petrol into the induction pipe. It has been proved by using the fuel I refer to that a reduction of at least 30 per cent. can be made in fuel cost.

To assist in the use of such mixtures several inventions have been put forward. For example, the Tate vaporizer relies on the initial heating of the fuel by subjecting it to the heat of a resistance coil. The supply of fuel to the heater is governed by an electromagnetic valve which is incorporated with the device and operated by a switch from the dashboard. A current of five amperes at six volts is stated to be sufficient to give the necessary heat for starting, which occupies a period of six seconds. In this time the intake manifold is supplied with sufficient vapor for the engine to be started.

Hamilton Bi-Fuel Carburetor.

The Hamilton bi-fuel carburetor provides for using a mixture of paraffin and petrol up to 60 per cent. paraffin and 40 per cent. petrol, two float chambers and two jets being provided, one for each kind of fuel. The two fuels in this ar-

rangement are mixed in a more or less vaporized state. For starting, the paraffin jet is closed, but with increased suction the air valve lifts and opens it up. The orifices of both jets can be adjusted by needle valves to give the correct proportions.

The blending of grades of hydrocarbons is not, however, a satisfactory method of dealing with the difficulty. With mixed fuels a broken distillation curve is obtained, and the low gravity fuel vaporizes before the high gravity fuel. A more satisfactory method is to continue distillation to a higher temperature and employ a fuel with a regular distillation curve, and one with which the percentage and temperature have some definite connection.

Diesel Type of Engine.

The Diesel type of engine for commercial purposes is worthy of close attention, as it can operate on heavy residual petroleum, coal tar oil, etc. With these fuels the cost of running works out at about ⅜d per horsepower per hour, or even less where coal tar oil is a local product, whereas the cost of running a petrol engine is about 1.5d per horsepower per hour with low grade petrol. Further than this, the Diesel engine loses little of its economy when throttled down. It is, however, heavy, costly to manufacture, and it has never been successfully operated at more than about 600 revolutions per minute continuously. This was with a single-cylinder engine of 116 mm bore by 160 mm stroke, in which a maximum horsepower of 7.65 horsepower was obtained at little over 800 revolutions per minute for short periods.

Dr. Diesel, in conjunction with a French firm, is engaged at the present time on experiments on a motor designed for commercial vehicles which, while working on the well known Diesel principle, will, it is expected, be comparable with existing petrol engines as regards weight and general dimensions. The weight difficulty does not appear so formidable as it did a few years ago; considering the light weight of aviation motors compared with that of vehicle motors, it is conceivable that, with the quality of material now available, the Diesel engine might be made of a weight approximating to that of the petrol engine. The greater difficulty would appear to be in the arrangement of the fuel feed, as the Diesel engine depends absolutely on having accurately measured doses of fuel fed to the injector nozzle of each cylinder ready to be blown into the cylinder by the use of compressed air at the beginning of the stroke, and during a portion of the piston travel. With a small engine running under variable load a safe and efficient device is difficult of attainment; the doses must be reduced with the load, and the amount required when running light is only about one-quarter of that at full load. A motor four-inch bore by 5.25-inch stroke would only call for a pump with a diameter of five mm and a stroke of 3.1 mm at full power; when running idle the stroke would only need to be .8 mm. With Diesel engines of larger size the pumps are made to deliver considerably more fuel than that actually required, and provision is made for returning the surplus to the suction pipe, an arrangement which would be impossible for the small fuel requirements of an automobile engine. There is evidence that in all probability existing difficulties will be overcome, especially as the high price of fuel today is an incentive to a development which would place the automobile internal combustion engine for commercial work on a really economical basis. In view of the difficulties in connection with heating devices due to the fact that kerosene is not a volatile fluid, and that the boiling point of some of its constituents is very near the cracking temperature, it would appear that the system of pulverizing is worth following up. The eminent German engineer, Dr. Carl Buchner, holds the opinion that kerosene and the heavier fuels should be treated just as they are in the Diesel engine, and we have evidence that kerosene in a finely divided state can be ignited without any heat appliances as exemplified by the Bellem system.

Cracking and Topping Plants.

The increased demand for and enhanced price of motor fuel has stimulated invention in the direction of improvements in cracking or topping plants, and almost daily some further improvement is claimed in connection with these plants. They all have the same object, namely, to break up heavy hydrocarbons of high boiling points into lighter hydrocarbons with low boiling points, and they endeavor to achieve this end by the generally familiar principles, either by distilling under high pressure or with great heat, and artificially increased heating and cracking surfaces. The high pressure plants are a revival of old patents somewhat changed and reconstructed.

Results of Recent Tests.

Some very interesting trials have been conducted by Dr. Dieterich with benzol and other fuels on an Opel car with an engine having cylinders 70 mm bore by 100 mm stroke with standard type of carburetor. The tests were made on a stretch of road 10 kilometers in length under equal conditions regarding temperature and weather. The results obtained with the different mixtures are as follows:

1. Ether—Ordinary ethyl made from alcohol and sulphuric acid, containing about 70 per cent. of carbon, eight per cent of hydrogen, and 22 per cent. of oxygen; specific gravity, 0.718 to 0.725; calories, 9000 per kilogram; price in Germany, minus the tax, 10d per kilogram. Used as fuel, unmixed, quickly stalled motor, mainly by reason of the great cooling produced by the rapid evaporation of this highly volatile liquid.

2. Petroleum-Ether—C_3H_8, C_4H_{10}, C_5H_{12} (mainly the latter, the pentane), containing 85 per cent. carbon, 15 per cent. of hydrogen; specific gravity, 0.650 to 0.680; calories, 11,000; price 7½d. Results poor, as under 1.

3. Ordinary Petrol—(Hexane, heptane and octane), carbon, 85 per cent., hydrogen, 15 per cent.; specific gravity, 0.680 to 0.720; calories, 9500 to 11,000; price 7d per kilogram. Produced a maximum speed of 50 kilometers per hour with a consumption of one liter for eight kilometers. The usual advantages over benzol and heavy petrol in the way of responsive acceleration and the greater power arising from rapid flame propagation.

4. Heavy Petrol—(Octane and higher grade paraffin), carbon, 85 per cent., hydrogen, 15 per cent.; specific gravity, 0.730 to 0.760; calories, 10,500; price 5¾d. Produced a maximum speed of 44 kilometers, and a consumption of one liter for seven kilometers. Motor sluggish and acceleration slow.

5. Benzol—C_6H_6; carbon, 92 per cent., hydrogen, eight per cent.; specific gravity, 0.8997; calories, 9500 to 10,000; price 4d. Gave nine kilometers to the liter, but a maximum speed of only 42½ kilometers. Same drawbacks as with heavy petrol.

6. Heavy Petrol and Ethyl Ether—Equal weight parts; price 8d. Results poor; very little power.

7. Same Ingredients—Proportion 1:1.5; price 9d. Results poor, showing ether to be useless for admixture, apart from price consideration.

8. Heavy Petrol and Petroleum-Ether—Equal parts; specific gravity, 0.701; calories, 10,000; price 6¾d. Gave eight kilometers to the liter, maximum speed 45 kilometers. The acceleration was better than with heavy gasoline alone.

9. Same Ingredients—Proportion 1:1.5. The results were almost as poor as with petroleum-ether alone.

10. Benzol and Petroleum-Ether—1:1.5; specific gravity, 0.705; calories, 10,750; price 6¼d. Gave eight kilometers to the liter; maximum speed 48 kilometers. Acceleration and results generally better than with benzol alone.

11. Same Ingredients—Equal parts; specific gravity, 0.725; calories, 10,500; price 5¾d. Gave eight kilometers to the liter; maximum speed 50 kilometers. Took grades on third speed which with ordinary gasoline required second speed. An important improvement upon unmixed benzol.

12. Same Ingredients—Proportion 2:1; specific gravity, 0.797; calories, 10,300; price 5d. Gave a little more than eight kilometers per liter, and a maximum speed of 54 kilometers. Took all grades with higher gears than possible with other fuels. Good acceleration and lively explosions. Better than ordinary petrol of 0.680 to 0.720 gravity.

The supplies of benzol seem to vary very considerably in quality, and in view of the position that benzol seems likely to take as a motor fuel, the present time would appear to be an opportune one for some standard of composition to be decided upon. The best volatility and the permissible amount of impurities such as sulphur should be ascertained and fixed, there should also be some limit to the amount of toluol which it is necessary to add to keep the fluid liquid at low temperatures. The worst feature in connection with benzol is, of course, its smell, but it is a fuel which must be encouraged by all possible means.

The Use of Naphthaline.

Some attention has been given to the use of naphthalene as a fuel. A trial was recently carried out in Paris with a two-cylinder Renault cab fitted with a special carburetor consisting of a melting receptacle in which the supply of melted naphthalene is maintained by the exhaust at a heat above its melting point, and from which it is conveyed to a heated float feed carburetor. The engine has in the first instance to be started on petrol in order to heat up the naphthalene. The time occupied in running on petrol before the naphthalene can be switched on is 13 minutes 37 seconds. A stop of 10 minutes can be made without any further use of petrol, while a stop of 16 minutes necessitates its use. The consumption worked out at 14.228 kilograms for 100 kilometers, at an average speed of 34.4 kilometers per hour. The price of the fuel was six francs per 100 kilograms, bringing the cost per 100 kilometers up to 0.85 francs, to which must be added the petrol for starting.

In another test conducted by the Automobile Club of France, a car when running on naphthalene showed an economy of 60 per cent. over petrol. In Germany the Gas Motoren Fabrick Deutz constructs a stationary motor specially designed for this fuel. The production of naphthalene in Great Britain is about 126,000 tons, in Germany 175,000 tons, and in France 30,000 tons. The chemical formula is $C_{10}H_8$, melting temperature 49.2 degrees C. and boiling point 218 degrees C. The combustion of naphthalene is very similar to that of benzol, and with practically the same heat value. The price of naphthalene in Great Britain is about 75s per ton, and its production is considerably greater than that of benzol, but to convert it into a practical fuel for motors is, I venture to say, more the work of the chemist than the engineer. I understand that a Belgian chemist has succeeded in reducing it into a permanent liquid by means of a solvent.

The chemical change which takes place in the combustion of benzol and naphthalene is as follows:

Benzol		Oxygen		Carbon dioxide		Water
C_6H_6	+	150	=	6 CO_2	+	3 H_2O
78 gr.	+	240 gr.	=	264 gr.	+	54 gr.
Napthalene						
$C_{10}H_8$	+	24 O	=	10 CO_2	+	4 H_2O
128 gr.	+	384 gr.	=	440 gr.	+	72 gr.

Energizing Petrol.

A good deal has been heard about energizing, or "doping", petrol by, among other substances, picric acid, which contains 48 per cent. of oxygen, but it does not readily dissolve in petrol. Ammonium nitrate, containing 60 per cent. of oxygen, is another suggested energizer, but this again is only slightly soluble in petrol and the same difficulty has to be faced with

acetylene gas. It is, of course, oxygen that is required in order to energize, and the only known means of admitting this is through the inlet pipe.

Both in France and Germany the conclusion has been arrived at that if alcohol is to be used it must be enriched or blended, and benzol has been tried for this purpose. The 'Bus Company in Paris has made extensive trials of mixtures of alcohol and benzol, in the proportions of 50 per cent., the consumption per kilometric ton being 0.09 liters. These motors were worked at a compression of about 100 pounds per square inch and ran at 900 revolutions per minute, and were fitted with an automatic regulator to prevent any increase. The most efficient speed was found to be 650 revolutions per minute. Experiments have also been conducted with a mixture of acetylene gas and alcohol. In the Barker & White system diluted alcohol is sprayed on to calcium carbide. It would appear that the addition of acetylene adds considerably to the speed of ignition of the vapor. Picric acid has also been suggested as an enricher of alcohol, but investigation in this direction has resulted in the conclusion that it is not practicable for the reason that picric acid when mixed with the water in the alcohol has a corroding effect on metals.

Alcohol as a Fuel.

In Germany, with stationary alcohol motors, efficiencies have been obtained reaching as high as 35 to 38 per cent.; such results, however, can only be obtained by very high compression, and by the addition of water to the fuel mixture in an amount proportional to the compression. An efficiency of 30 per cent., however, can be taken as representing the average which can be obtained with a well designed stationary alcohol motor. Taking the efficiency of alcohol at 30 per cent. and the efficiency of petrol at 20 per cent. it will be found that there is a gain of at least 10 per cent. in favor of petrol by volume. It would seem, therefore, that under the best conditions a gallon of alcohol would never have the same value as a gallon of petrol. Under normal compressions all records go to prove that the consumption of alcohol is at least 50 per cent. greater than that of petrol. It has yet to be proved that alcohol can be utilized at a high efficiency with a small high speed engine. All data we have as to efficiency have been obtained with slow running stationary motors.

The slow rate of flame propagation is claimed by some to be an advantage. No doubt it gives a somewhat smoother running engine, but it is undoubtedly at the expense of power. Alcohol is a fuel which can only be considered provided it can be utilized as cheaply as other fuels. It is quite evident that 90 per cent. alcohol, as we know it, is not to be compared with petrol for high speed motors. Its heat value is low, there is difficulty in starting from cold, and it requires high compression if it is to be used with economy. The petrol engine as now constructed is quite unsuitable for alcohol, and even if alcohol were available as a fuel today the price would have to be a very low one indeed to compete with other fuels. In Germany, where the question of alcohol has been thoroughly studied, it is only used for slow speed stationary engines.

Research Work Necessary.

Before the question of the suitability or otherwise of alcohol as a fuel for automobiles can be fully decided, a tremendous amount of research work is necessary. In the first place there is the question of the production of the alcohol in sufficient quantities at a price which will make its use economical. I think it is quite useless to contend that alcohol can be made at a competitive price from potatoes or beets grown in this country. According to some authorities alcohol can be manufactured in the British colonies at 4d to 6d per gallon, and from peat at even less cost. If the motorists in this country are serious in the endeavor to provide a fuel which can be produced in unlimited quantities and not subject to market fluctuations, they should get together and devise some scheme whereby sufficient money can be provided to solve or decide the question as to the possibilities of alcohol. No doubt many of our colonies themselves would contribute to such a scheme. It seems somewhat ridiculous to pass resolutions to the effect that alcohol is the only fuel which will save the situation and to take no action to carry such resolutions into practical effect. The commercial vehicle is in need of a cheap fuel, and if alcohol could be produced at the low prices stated, means would be found to employ it economically.

Suggestions have been put forward regarding the equipment of vehicles with a producer gas plant, and such a vehicle was constructed in the Glasgow district a year or two ago. The project does not appear impossible of realization with the use of anthracite or charcoal as the fuel. With the Glasgow vehicle using anthracite coal the consumption worked out at about 1.125 pounds of coal per ton-mile, or 1025 ton-miles for half a ton of fuel at 20s per ton.

The Bonecourt Flameless Combustion might well receive consideration for steam generation. Although the system of combustion has not yet to my knowledge been applied to steam road vehicles, it certainly must appeal to those who are advocates of steam vehicles for commercial use. The Bonecourt system offers a possibility of a small flameless oil fed boiler generator in conjunction with a small turbine motor. This system of combustion consists of a burner surrounded with granulated fireproof material. The gas mixture is forced in under pressure, when the fireproof mass becomes incandescent, combustion taking place within the mass. The efficiency of the burner is very great in raising steam, while the amount of air for effecting combustion does not exceed the theoretical amount by more than about one-half of one per cent.

At the present time the petrol internal combustion engine has practically no rival, but in commercial work Providence is always on the side of low prices, and if by reason of the price of petrol other systems than those with which we are now conversant turn out more economical they will surely come to the front. We engineers have no axe to grind as regards fuel, and study all propositions with an open mind.

PETTIT NOW SALES MANAGER.

The marketing of the production of the Commerce Motor Car Company, Detroit, Mich., maker of Commerce delivery wagons, is now directed by W. C. Pettit, who recently assumed the duties of sales manager of that company. Mr. Pettit was for a considerable length of time connected with the Studebaker Corporation as manager of advertising, and has been for a number of years identified with other interests of the industry. He is widely known to the trade throughout the country, is very familiar with the conditions generally, and is unusually well qualified to carry on the vigorous selling campaign that has been projected by the company. The policy of the Commerce company has been to establish distributing agencies in different sections of the country and for three years introductory work has been carried on until conditions appear to be extremely favorable for broader and more carefully systematized endeavor. This is the foundation with which Mr. Pettit begins his work with the Commerce company

W. C. Pettit, New Sales Manager of the Commerce Motor Car Company, Detroit, Mich.

The Willys-Overland Company has elected the following officers at the annual election held at Toledo, O.: President, John N. Willys; first vice president, Isaac Kinsey; second vice president, Carlos Jameson; secretary, Royal B. Scott; treasurer, Walter Stewart; comptroller, A. H. Smith. The officers and Rathbun Fuller compose the board of directors.

The National Motor Truck & Manufacturing Company, which was recently organized to do business at Gibsonville, O., under the management of Frank Lamb, formerly of the Gramm Motor Truck Company, has discontinued its business.

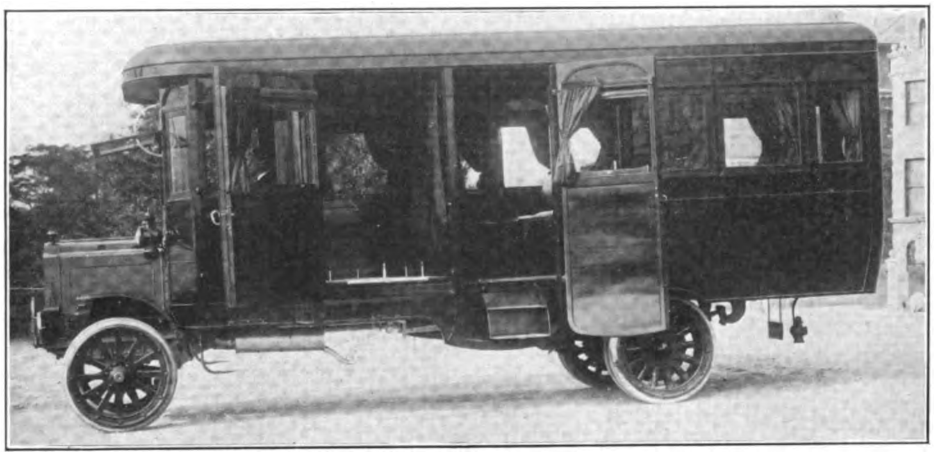
The Perfex Company, that is to build a light delivery wagon, has established itself in a new factory at Santa Fe and 52nd streets, Los Angeles, Cal., and is to begin production immediately. The machines will have capacity of 1000 pounds or less.

FUNERAL CARS FOR RENTAL.

Motor Coach Company Specializing Equipment for New York Mortuary Service.

The building of special funeral cars that will convey a casket, a clergyman and 20 persons beside an undertaker, and will replace a hearse and five or six carriages, has been begun by the Motor Coach Company, Inc., of New York City, the intention being to rent these vehicles to funeral directors or to supply them as required at charges depending upon the service. There are many cemeteries in New York, but generally in the suburbs, and the time required to go from residences to the burial places, and the difficulty of moving a funeral train through streets crowded with traffic, prompted the building of vehicles that would carry such a number as might ordinarily accompany a body to its last resting place.

The company is now producing these vehicles and the expectation is that they will be built in such numbers as will meet demands, for assumedly the advantages are numerous and the cost of the service can be no greater than with the animal vehicles that have been customarily used. The company has selected three-ton truck chassis, that illustrated being a Packard, and on these installs bodies that are built with four divisions. The forward section is intended to carry the driver, the clergyman and the funeral director. Back of this is a compartment for the casket, above the space being a wide shelf for the floral remembrances. The third section is for the friends, and the fourth for the family, they having such seclusion as would appear desirable.



Funeral Car and Emergency Chapel Built to Special Designs by the Motor Coach Company, New York City, for Rental Purposes.

The first three sections are all accessible by side doors from the walk, there being steps for the first and third doors, and the interior of the body is fitted with every adjunct for comfort and convenience. An electric fan cools the passenger space in heated weather and in winter the passengers are warmed by air heated by the exhaust pipe. The lighting is by electric dome lights, and the equipment includes a water cooler, fans, mirrors, hat and coat racks, flower vases, and there is ample provision for ventilation. In the event of storm, services can be held in the passenger section.

The bodies are handsome examples of coach building, being finished in Brewster green with black striping and silver trimming, and the interiors are finished in mahogany with black or dark green curtains and draperies, dark carpet and black leather upholstery.

STUDY TRAFFIC PROBLEMS.

Motor Truck Club Makes Comparisons of Conditions Locally and Elsewhere.

The Motor Truck Club of New York City, at its October meeting discussed at length the "Influence of the Motor Truck on the Traffic Problems of a Great City", the principal speakers being Dr. E. E. Pratt, manager of the industrial department of the Merchants' Association of New York, and Frederick Van Zandt Lane, secretary of the Property Interests Association of Jersey City. Both were of the opinion that there was a large measure of highway economy obtaining through the use of motor vehicles, a factor of immense importance in traffic and where the streets are congested, but because of the rapidity of evolution in transportation resultant from their use it has been or will be necessary to make changes in the use of the thoroughfares so that the greatest efficiency of the machines may be realized.

Both speakers were in accord in the belief that what was really necessary was careful study of the entire subject of highway transportation, both by municipal and state commissions, provided that any commission is not legislative, that would form conclusions from economic and scientific viewpoints and make recommendations that would bring about satisfactory results. The traffic congestion was regarded as being greater in New York than anywhere else in America, and whatever should be done by a commission should be upon a basis of fact and not theory. The congestion is dangerous from the viewpoint of safety and enormously costly from the viewpoint of economy, which cannot be solved by the use of the motor vehicle unless it is used with a view of conserving both.

A company has been organized at Baltimore, Md., for the purpose of affording a motor omnibus service in that city. The company proposes to use machines with two decks, having a passenger capacity of 38.

A branch is to be opened at Boston, Mass., by the Gibney Tire & Rubber Company of Philadelphia, Penn., which now has a branch in New York City

The
MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. IV. PAWTUCKET, R. I., DECEMBER, 1913 No. 12

FEDERAL REPORT THREATENS INDUSTRY.

Director of Office of Public Roads, in Report of Investigation of Rhode Island's Highway System and Road Board, Recommends Raising Funds for Highway Maintenance by Increasing the Fee for Motor Truck Registration.

A REPORT submitted to Governor Pothier of Rhode Island by Logan Waller Page, head of the office of public roads of the United States Department of Agriculture, which makes recommendation that the state specially tax motor trucks to provide funds for the maintenance of the state highway system, discloses a policy that can as reasonably be applied to every state of the nation, and is unmistakably threatening to not only the motor truck and wagon industry, but will materially affect every person owning such vehicles. This report is of record and it is based on an investigation made into the administration of the state board of public roads. Just what prompted this inquiry is not stated. The entire highway system of the state was inspected, the records examined and the report was written by T. Warren Allen, a senior engineer attached to the office of public roads, and from data submitted by J. T. Veshell, engineer, and C. S. Reeve, chemist, both employed by the same bureau.

The specific recommendation is one of six, and it is as follows:

Highway at Rumford Station, East Providence, R. I., Showing Unimproved Road in Foreground, Constructed in 1912—Typical Illustration of Relative Conditions of Good and Bad Thoroughfares.

"Fifth, amend the automobile law, raising the rates for automobile trucks, and specify that the funds derived be applied to road maintenance solely, except for such an amount as is necessary to pay the expenses of conducting the automobile division of the department".

This report, being made by an employee of the office of public roads, undoubtedly, with the approval of the director of the office, is of great significance. It is a recommendation that the state specially tax motor trucks for the maintenance of highways, and these machines are now taxed by the state as personal property at the rate of $16.50 for each $1000 valuation, and were the tax for road purposes imposed this would without question, mean double taxation, which is beyond doubt unconstitutional.

The fact is patent that if the national government, through its officials, can supervise, direct or shape legislation in Rhode Island, it can do the same in every other state, and with the Rhode Island investigation as a precedent there is apparently every reason to believe that this policy will be continued unless the mo-

State Road in South Kingstown, R. I., an Illustration of the Character of Country in Which Much of the Improvement Is Made.

tor vehicle industry and those using power wagons and trucks, and every business interest that is concerned, will unite in an endeavor to determine the constitutionality of double taxation.

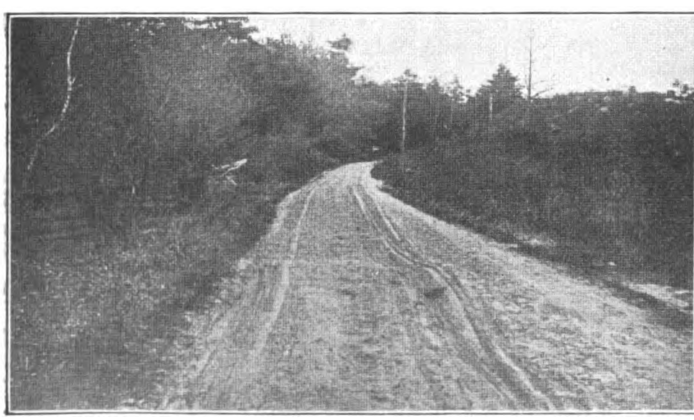
Federal Policy Far Reaching.

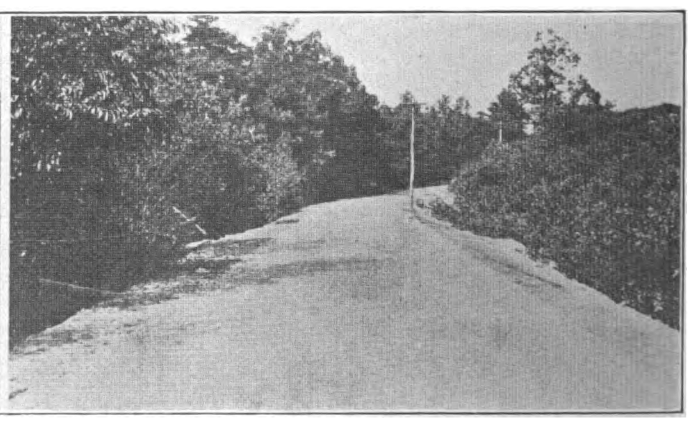
The results of this report are so far reaching and so apparent that one does not need to go into the details or to analyze facts. The official report of the office of public roads, submitted by the director, has made the recommendation stated and this can be accepted without qualifications. First, the proposal is made to amend the present state law for the purpose of increasing the fee for registration, so that it shall specify that the revenue shall be applied to road maintenance, save the amount that is necessary to pay the expense of conducting the automobile division of the department.

Analyzing this, it will be seen that every fundamental for a tax for the purpose of raising money to defray highway maintenance is proposed, that how this money shall be applied is to be provided, and that it is intended that the revenue shall be more than the cost of maintaining the division that has control of automobile registration. This means, if it means anything at all, a special tax on motor trucks to raise money, and for a specific purpose.

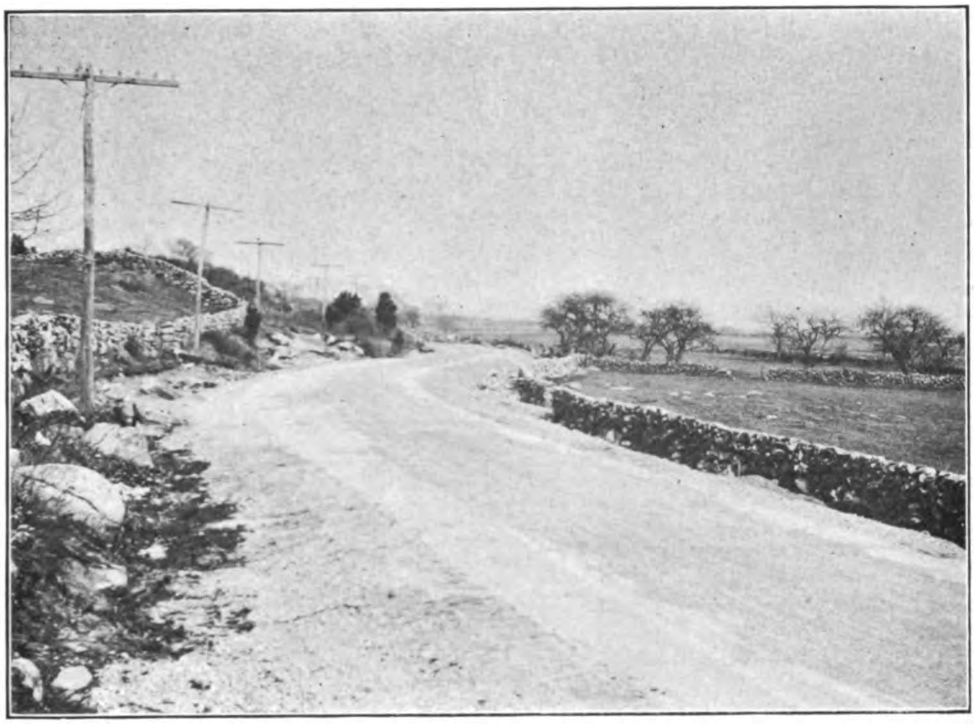
Motor vehicle registration is exacted under the "police power" of a state, which is a very indefinite and uncertain authority, and which has been or can be exercised to whatever extent the people are willing to tolerate. Originally the fees were based on the assumption that a sufficient revenue should be derived to maintain the office, or to pay the expenses of registration. Registration is primarily required to insure identification of machines and insure protection of persons and property. The proportion of the fee does not in the slightest add to the safety of the public. Automobile registration fees have, however, been increased by legislators for the avowed purpose of obtaining revenue, generally because of the indifference of the motorists themselves.

Automobile registration statutes vary materially. In no two states are the laws identical, and the fees are payable to state boards, state officers, commissions, court clerks, county clerks, and in some instances to town and city officials. These fees are applied to different purposes, but with rare exceptions there is always an excess of revenue over the expenditures for administrating the office of the official of jurisdiction. Owners of pleasure cars in many instances have expressed willingness to pay a tax, believing that good roads contribute to their pleasure and lessen operating expenses, and the majority are not unwill-





Typical Rhode Island State Highway: Section of Road in West Greenwich, a Sparsely Inhabited Town, but an Alternative Route to Westerly, Before and After Improvement in 1908.



Portion of the Highway Used as a Main Route Through the State, Near Westerly, That Was Constructed in 1912, and Is Now Much Travelled.

for any class of motor wagon or truck, and this was fixed on the ground that, being used for business purposes and being taxed as personal property, they should not be again taxed for any other purpose. This fee was determined after consideration of this important fact by the legislative committees, and the intention was that there should be no hardship imposed on any business man. Had not the attention of the legislators been specifically directed to the importance of a minimum fee on power wagons and trucks there is no doubt there would have been uniform fees exacted on the basis of horsepower rating, and the bill that was under consideration so provided, but amendment was made in committee by unanimous consent when the effect of taxing the vehicles of business men had been carefully considered.

ing to spend money for amusement and recreation with lavishness and to an extent they would unhesitatingly resist in business transactions.

There is a decided difference in attitude of owners toward a tax on pleasure and a tax on business, and yet there has been, because of the comparatively small number of power wagons and trucks, a general disposition of legislators to include them in the same classification as regards registration fees as pleasure vehicles. Because of being so few in number as compared with owners of passenger motor cars those possessing trucks and wagons have seldom succeeded in having registration fees less than those exacted for the former class of vehicles, though in some instances this has been brought about by the forethought of men who had realized the possibilities of power wagons and made convincing arguments for their exemption.

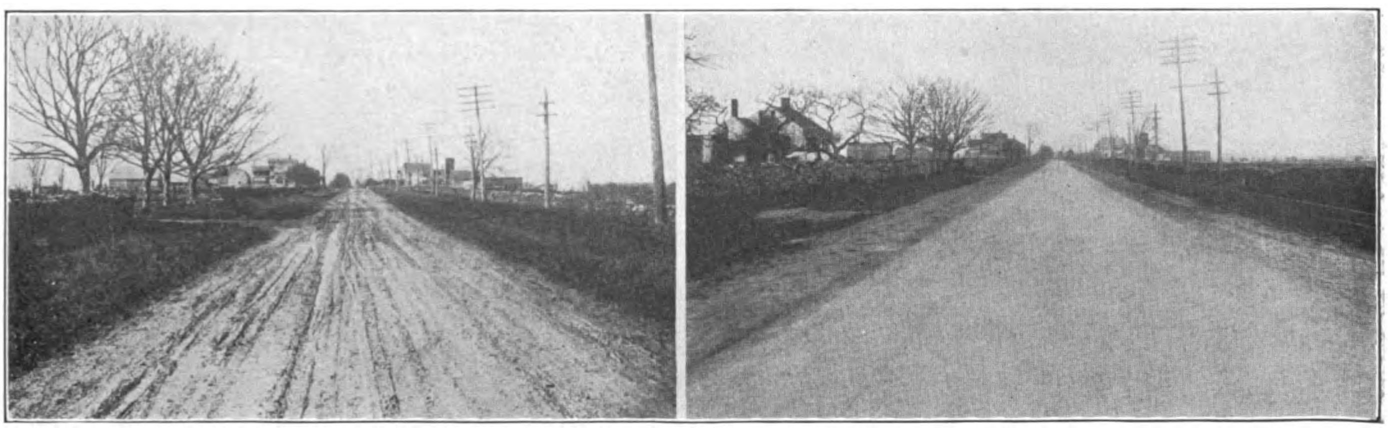
Rhode Island Fee Not a Tax.

This condition obtains at the present time in Rhode Island, where the registration fee was placed at $2

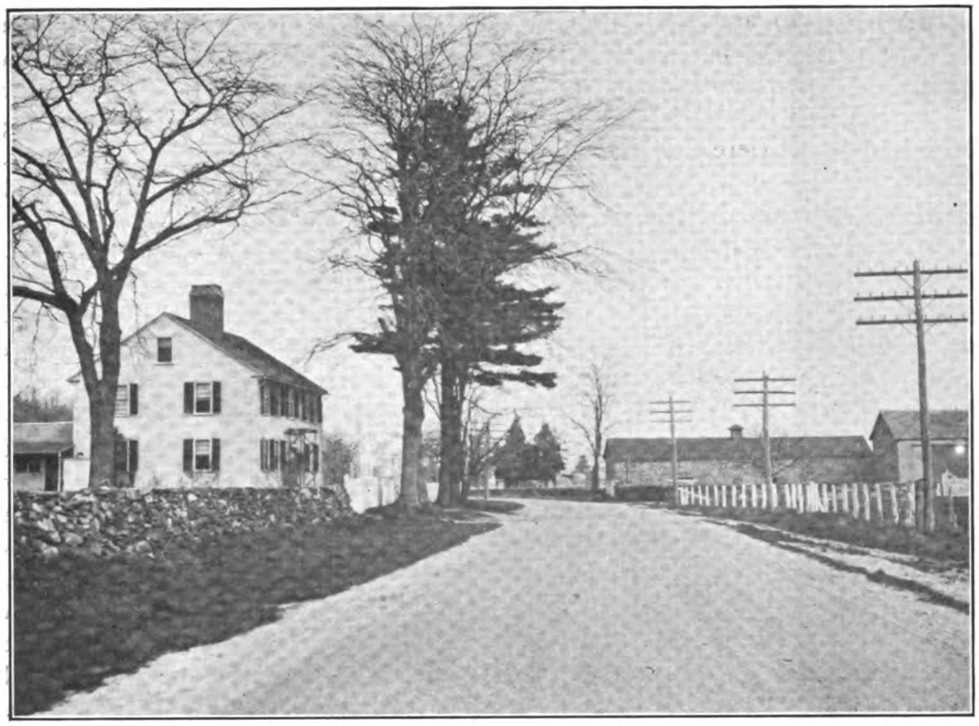
Possibilities of Trucks Realized.

No claim can be made that there was no knowledge of the probability of the increase of power wagon traffic on the highways. At that time it was believed by the committee that the use of machines would be a distinct benefit to business men, and it was understood that the real advantage obtaining would be in extending delivery from the cities that are the commercial centres of the state. Not only this, it was believed that wagons and trucks would be used solely for business purposes and that the greater part of the haulage with them would be within these cities. That is to say, that while the highways would be used by motor freight vehicles making deliveries from the cities into the towns the country residents would have equal benefit from service that was not then practical or possible, because of business competition.

The state board of public roads of Rhode Island



Stretch of Main Highway in Middletown, the Only Route North from Newport, and Greatly Travelled, Showing Conditions Before and After Improvement in 1908.



Section of Elmwood Avenue, Town of Warwick, Tar Built in 1912, This Being a Fair Representation of the Condition of the Surfacing After a Year's Use.

wider than standard 14-foot macadam surface built by the state was desired by a town the additional work was charged to and paid for by the town.

Water bound macadam was considered exclusively until 1906, and then attention was given to tar construction. This was experimental work, however, and the binding was generally asphalt, tar or mixtures of these materials, although several sections were built with a binder of refined tar. In 1907 a few miles of highway were constructed with bituminous material, and then the board awaited the result of usage of these roads. In 1909 real headway was made in tar construction, which was regarded as producing a superior

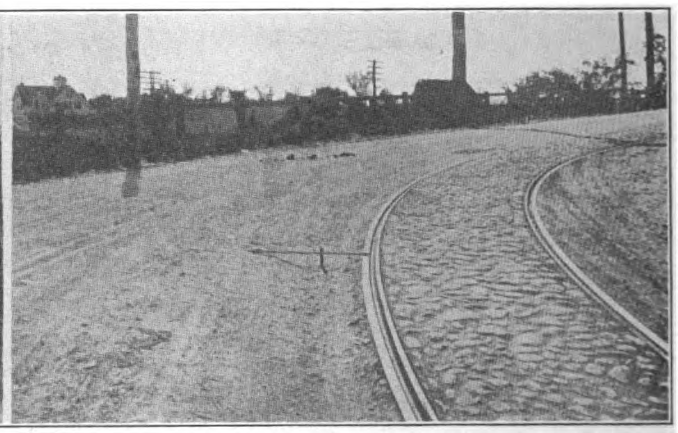
consists of five members and was created in 1902. The members were chosen by the governor, each to represent one of the five counties of the state, and they were to serve without pay. These men were prominent politically and were all Republicans. The board was authorized to construct and maintain stated main roads as state highways, some of them then existing. The state, under the provisions of the act, assumed control of these sections of improved highway and was expected to maintain them, and to construct new road to connect these sections. Appropriations were made and the work was begun, a state engineer being appointed whose duties were directed by the board. A standard road specification was adopted and contracts were made, in some instances with contractors and in others with the towns, so that the highway departments of these towns built some of the road, preference being given to the town construction when estimates were no more than contract bids. If a road

and more enduring surfacing. Since that time tar has been used to a considerable extent by the board in its work. About 26 miles of highway were built with that material up to 1912, when the construction specifications were changed so that a refined tar was required and all the contracts made specified this material, while the resurfacing in connection with maintenance was done with this binder.

One Change in 11 Years.

At the beginning of 1913, however, the board changed its policy, and because of the rejection of the proposed bond issue by the people and the lack of funds, new work, aside from the contracts previously made, was abandoned, and attention was practically given to maintenance. In November the first change was made in the personnel of the board, this being due to the death of John H. Edwards, who had served as chairman continuously from the creation of the body. His successor has been named.

Tar-Asphalt Highway in Town of North Kingstown, Built in 1909, a Fair Example of the Construction of the State System.



Water-Bound Macadam Road at Greenwood, Town of Warwick, Showing Wear at Curve, Before Rebuilding with Tar.

In the statements made that were intended to, and did, defeat the proposed issue of highway bonds, it was specifically pointed out "that there was one or two good men in the board", and the inference was made that the other members were not capable or were negligent. It was further maintained that there could be no improvement save with a change in the makeup of the board. There was at least implication that the administration of the board was extravagant, that there was lack of system and organization, and that the methods were such that good roads could not be built and kept in the condition essential for economic haulage without radical changes. The first attack was directed at the board as a means of defeating a bond issue. The charges implied practically everything that could be conjectured, and might be construed to mean political preferment, negligence, incompetence, extravagance, graft and the like. But after the defeat of the bond issue nothing further was stated until an engineer of the office of public roads of the Department of Agriculture appeared in Rhode Island and made an "inspection" of the state road system and examined the records of the office of the board of public roads.

The advent of this expert was given material publicity and he was accompanied in his tour of the state by representatives of the same newspaper that had attacked the bond issue. After he returned to Washington nothing more was heard of the subject until the report was submitted to Governor Pothier. Who brought the representative of the federal government to Rhode Island, by invitation or suggestion, what authority justified his inquiry into state methods, what reason prompted the submission of the report to Governor Pothier, and by what measure the efficiency of the board of public roads was determined, are questions that are now being agitated by the people of the state.

Motor Vehicles Pay 12.5 Per Cent. of Funds.

What interests the people is what the state has for the money raised and expended by the board. Up to the present time the board has had placed at its disposal a total of $2,965,072.48, of which amount $76,618.02 was received from towns for additional construction and $344,288.09 from the registration of motor vehicles. Of this revenue $2,417,692.98 has been expended for new construction, and $546,408.92 for maintenance, leaving unexpended $970.58. Of the total revenue of the state for highway repair and maintenance about 12.5 per cent. has been received from the registration of motor vehicles, so that the remaining 87.5 per cent. is contributed by the taxpayers. In other words, $1 of every $8 spent on road building or maintenance has been paid by owners of motor cars, wagons and trucks.

If the criticisms of the federal road engineer are well founded and correct, and the administration of the board of public roads has been all that those attacking it maintain, the fact that the automobile owners have paid a very heavy tax cannot be denied. Not only this, these vehicles have been taxed as personal property, and there is very general feeling that the valuation placed on motor vehicles has been excessive.

With the publication of the report, which was offered for publication by Governor Pothier upon its receipt, the Rhode Island Motor Truck Owners' Association, which was organized a year ago because of legislation pending that purposed to increase the registration fees on motor trucks, and which includes in its membership some of the largest industries of the state, began a campaign to oppose any attempt that shall be made at the coming session of the legislature to increase the cost of motor truck registration.

Truck Owners Act for Protection.

The association points out that if the money appropriated and raised by the people has not been expended by the board of public roads so as to obtain satisfactory results, if the roads have been poorly constructed, badly maintained, and if every implication made against the state authorities is substantiated by fact, this is not the fault of the people, nor of those who contributed to the highway fund, and to single out the owners of motor trucks as the subjects of special taxation is not only not justified, but it is against public policy and is unconstitutional. If the roads are not constructed to good engineering principles, if the materials are not enduring, if maintenance is neglected, this is because the board of public roads has been permitted to exercise its own will, and it is not responsible to the people. The board members are appointed by the governor with the advice and consent of the state senate, and if there were a complete change in the state administration it would take three years, without death or resignation, to even gain control of the board, for the members serve for five years.

The board was created with the approval of the people and it has as it is now constituted practically unlimited power. First the members served without compensation, probably because of pure patriotism, but later on all were given an annual salary. The state roads are built with a six-inch macadam surface. This construction was found to be insufficient under the heavy traffic diverted to them. Then the tar construction, which cost from $1500 to $2000 a mile, was adopted. This was an improvement, but it will not long endure under heavy mixed traffic. Heavier surfacing is imperative, and this costs money. The patchwork policy to meet political demands has been very expensive.

The federal officials appear and make report that "motor trucks should be taxed". This means a new policy, if it has the sanction of the government, and if it is applied generally, as it apparently can be, then this means that the motor vehicle industry, the owners of motor vehicles, and business men generally, will not be permitted to use this means of transportation without additional taxation. It is a serious situation, and should be given immediate attention.

MOTOR DELIVERY SHOWS 40 PER CENT. ECONOMY.

Remarkable Efficiency of Electric Wagons When Worked in Same Service with Animals in New York City, Under the Supervision of Transportation Expert.

SCIENTIFIC administration of transportation is always productive of results. This fact has been amply demonstrated, yet business enterprises seemingly well managed have failed to give attention to economies that are absolutely practical. This apparent neglect is not disregard of expense, but is generally resultant from ignorance of organization and method and the absence of accounting.

Comparison of work with different equipment is usually believed sufficient on which to base judgment, but unless based on established fact any determination is worthless. Accounting can prove the efficiency and expense of any haulage service quite as well as any other work, but unless accounts are carefully analyzed and studied the possibilities for saving cannot be realized.

Considering this subject, it is well to accept that greater efficiency is practical, and to fix a standard with a view of developing the service to at least yield these results. Records will show what has been accomplished, but unless improvement is sought progress cannot be made. With a definite purpose in view and with a knowledge of what has been done it is intensely practical to make such changes as will decrease expense or increase the work at no greater cost. This policy can be adopted with reference to horse equipment, and it can be applied to motor installations equally well. Economies can be obtained, and when the possibilities have been realized the value of administration can be definitely established.

Atlantic One-Ton Wagon with Panel Body Built for the Delivery Service of A. Silz, Inc., a New York Poultry House.

Horses vs. Motor Equipment.

When horses have been used so that the greatest practical service has been realized the question of utilizing motor equipment can only be decided by use with methods similarly adapted. That it may be necessary to make many changes and revise system and improve facilities is unquestioned, but it is also possible to work out material saving with the use of motor wagons and trucks with the same methods, and supervision.

When motorized transportation equipment has been substituted for animal vehicles the economy is assumed to be in superior speed and increased capacity of the machines, and these qualities are depended on very generally instead of reorganization and methods that will develop efficiency. By this is meant that many times the mere change from the one type of vehicle to another is expected to be productive, instead of studying the work and developing every quality that will yield results.

There are instances where men with long experience with horses have been very successful with management of motorized services, both as regards work and maintenance, but these are exceptions to the rule. Such men as have made successes usually have good knowledge of operating data and have studied the conditions of work and have adopted such methods and systems as promised to be productive. The greatest cause of failure of men familiar with horses to obtain material results from motor vehicles is inexperience with machines, which prevents working them to the greatest advantage.

Men specializing transportation efficiency are few, and their services must usually be paid for as experts, for their experience can only come with careful study of installation, the use of vehicles of all types, and the knowledge of the relative values of organization and system. They must also be capable of investigating a department, determining its faults and extravagances, learning the possibilities with continuation of the conditions of use, and after careful observation and analysis making changes that will bring about the highest efficiency and saving that is practical.

The careful expert will, if conditions justify, ask for such accounting as will establish operating expense, and from these data he will make plans for development. Such a man can establish a standard for work and endeavor to reach this productiveness. There are those who will maintain that so many variables exist that no stated value can be placed on them, but with record of what has been done experiment can be made that will determine all subjects which cannot be

worked out. Working different men and different vehicles in known conditions affords a very substantial basis for determination.

A striking example of what can be accomplished is that of A. Silz, Inc., a firm at 414-8 West 14th street, New York City, which has a transportation department in charge of Homer E. Waltermyre, an expert on haulage, and it is all the more interesting because it is what may be termed a combination equipment, there being both motor wagons and horse wagons used.

Business of Silz Firm.

The company is one of the largest of its kind in America and does a business that will closely approach $5,000,000 a year, specializing in poultry and game birds and animals. The stock is received from all sections of the United States and Canada and is brought from the railroad terminals and piers to the main storehouse. From this point it is distributed. While the firm will make shipments to any part of the country and in any quantity, its business can be said to be practically in New York City, for 85 per cent. of its deliveries are within the five-mile zone and 95 per cent. within the seven-mile zone, the remainder being sent to points beyond.

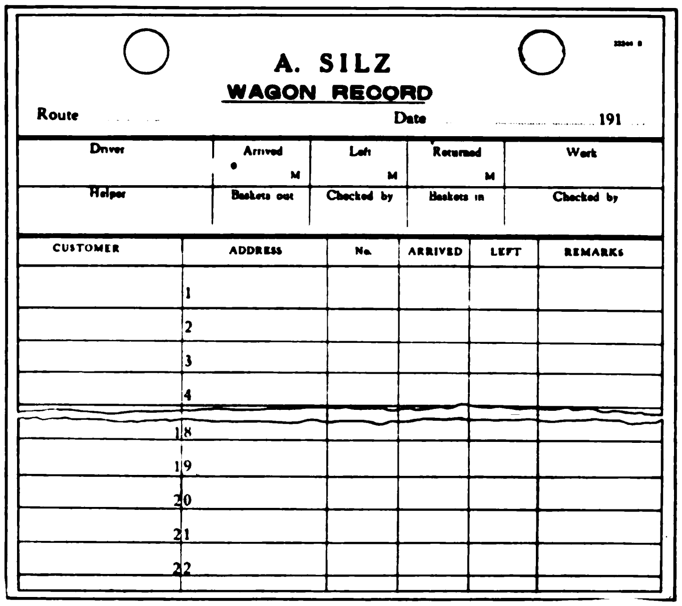
The company does not sell at retail and much of its business is with hotels, restaurants, clubs, hospitals, and the European steamship lines that have metropolitan terminals, most of the last named class being at Jersey City and Hoboken, across the North river from Manhattan. The regular delivery of the firm is made in Manhattan south of 175th street, the central part of Brooklyn, and the river front in Jersey City and Hoboken, while occasional deliveries are made to sections outside or beyond those named. In distribution horse wagons are used within a radius of three miles from the store, and beyond this motor wagons are utilized. The company maintains its delivery wagons to a high standard. The vehicles are all handsomely painted and decorated and are kept scrupulously clean and bright. The drivers are all uniformed and during the greater part of the year white duck is worn by them. The company provides the uniforms and insists that the men be always neat and their clothing unsoiled when they leave the store, so it will be seen that more than ordinary attention is given over to appearance.

Adoption of Motor Wagons.

The company has been established about 15 years, beginning in a small way, and its business has increased to its present proportions chiefly because of the quality of its stock and the satisfaction obtaining with its customers. For the first 10 years the delivery was by horse wagons, and after that time motor wagons and trucks were used to some extent, the first experience being with gasoline machines, which were followed by electric vehicles. The stable was located in a separate building directly back of the main storehouse and salesroom, this being a six-story structure, 75 by 30 feet. The location was regarded as unusually favorable because the animals had merely to be driven about the square between the store and stable, minimizing the travel incidental to the work. The gasoline cars were kept in a garage, but when the first electric wagon was purchased, this being a General Vehicle machine of 2000 pounds capacity, it was garaged in the stable.

Duties of the Expert.

Until the late spring of 1912 the delivery department of the company was directed much the same as are thousands of others, and then with a view of learning the possibilities of economy from any changes that might appear desirable, Homer E. Waltermyre was engaged to study it with a view of making observations and recommendations that might appear practical. Mr. Waltermyre, as he expresses his vocation, is a "doctor of sick delivery systems" and he had specialized in this work for several years. Until then he had worked as an expert, making investigations and developing systems and methods that could be applied to the particular subjects of his inquiry, and he


A. SILZ
WAGON RECORD
Route Date 191

Driver	Arrived M	Left M	Returned M	Work
Helper	Baskets out	Checked by	Baskets in	Checked by

CUSTOMER	ADDRESS	No.	ARRIVED	LEFT	REMARKS
	1				
	2				
	3				
	4				
	18				
	19				
	20				
	21				
	22				

Wagon Record of A. Silz, Inc., Printed Black on White Paper, with Red and Blue Ruling, with Copy on Yellow Paper, 11 Inches Length and Seven Inches Width, Perforated for Loose Leaf Binding.

charged for this work such fees as the time required appeared to justify.

He expected to devote about three weeks to this client, but the results obtained were so practical and the economies so substantial that he was requested to continue his supervision, and has done so since that time. This means that this firm has regarded the services of an expert sufficiently productive to justify what may be considered a permanent engagement.

Equipment and Methods.

In the service at the time this work was begun were several machines, and a considerable number of horses. Changes have been made and at the present time the equipment consists of two gasoline machines, one of which is a 3.5-ton truck and the other a 2000-pound wagon, one General Vehicle 2000-pound wagon, a Champion 2000-pound wagon and three 2000-pound Atlantic wagons, the last five being electric ve-

hicles. In addition 17 horses and six wagons of 2000 pounds capacity are used. This department is worked systematically, the horses being used within a radius of three miles, the machines generally beyond a radius of three miles; no deliveries are made by horses where the haul is outside the zone they are worked in. Nine miles is regarded as a long distance delivery and few are of this length.

Observation of the delivery shows that it has been carefully systematized. The stock is generally hauled from the terminals to the storehouse by horse wagons, and it is kept in cold rooms. When wanted it is brought out to the main floor of the building, which is level with the street, and there the orders are made up. The orders are assembled in baskets and stacked in the order they are to be loaded, this work beginning each business day morning at 4. At 5 the loading is begun. The wagons are not all waiting at that hour, but they are relayed, those going the longest distances being loaded first and the others following until all are sent away. The first loads are thus made up, but after that time the vehicles are freighted as they return to the store, the work continuing until about 2, when usually the last vehicle is dispatched. After that hour the work is more with special orders, which may not be full loads, although endeavor is made to have each wagon or machine carry as much as is possible. Emergency orders are sent out as special deliveries whenever conditions require.

The sidewalk in front of the building is wide and is partly covered with a canopy, and there are wide entrances so that the men can work in loading without delays of any kind. The wagons are backed against the curb and the baskets are carried out by hand as a rule, although an experiment is being made with the use of small trucks which will each carry a stack of baskets.

As the load is made up on the floor the orders are checked and when the loading is progressing the wagon record is filled. This gives the number of the route, the date, the names of the driver and his helper, the time of arrival at the store, the time of departure, the time of return and the nature of the work, the number of baskets taken out, the name of the checker, the number of baskets returned to the store and name of the checker. Baskets are checked when sent out and received. The blank has space for 22 entries and each line gives the name of a customer, the address, the number of baskets, the time of arrival at and departure from a customer, and remarks whenever anything is necessary to report. This record is made out in duplicate and the original is taken by the driver, he entering the time of arrival at and departure from a customer, and remarks. The copy is kept in file at the office as a record and the original is also filed and preserved. These are filed in loose leaf binders.

How Records Are Made.

The record of the vehicles includes the mileage, which is taken each day from the odometers, and this is used in fixing the distance each tire is driven, as well as the consumption of fuel, oil, grease and electric current. With reference to the tires each wheel of a motor vehicle is numbered and the record of each wheel is kept, this showing the distance each tire has been driven, but in addition the name of the maker, the size, serial number, type, cost, the dates of installation, removal, repair, replacement or manner of disposition, with adjustment, are kept. With the electric wagons a record of the battery is kept, this showing the make, size, type, date of installation, repairs, date of removal, work involving any expense and other detail.

The detail record of the machine includes the make, capacity, type, cost, date of delivery, and date service began, and in connection with this is kept note of the operating expense, including repairs, maintenance, etc.

This information is supplemented with the cost of garaging, labor, attention, supplies, fuel, electric current, insurance, depreciation, interest, taxes, administration, and from the daily records a monthly statement is made up with reference to each vehicle, this showing among other data the number of the machine or wagon, the monthly and daily mileage, the average cost of operation for each mile, the total number of deliveries and the average cost of each delivery.

How Efficiency Is Measured.

A standard of efficiency is fixed and against this is placed the percentage of this standard that is represented by the work done with each machine or wagon, and the value of this statement is far greater than might be assumed, for efficiency is of record as low as 56 per cent. and as high as 94 per cent. (this with reference to motor wagons), and as high as 85 per cent. with horse wagons. This percentage is computed against each wagon or truck and as the same factors are considered it is evident that this comparison is accurate and thoroughly dependable.

When the electric machines were kept in a public garage the cost was estimated on that basis, but in addition estimate was made of the expense if they were maintained by the company, and this was found to be so much less as to justify the company in transforming a part of its stable into a garage. The expense figures realized entirely justified the expense of the investment.

The average cost a mile for operating expense is found and against this is charged the number of deliveries, the average of delivery cost being found. A delivery does not mean a stated volume of goods, for this will vary from 25 pounds to a ton, but careful observation has established that this is an entirely safe basis and is accepted as accurately representing the work. To illustrate: In March, 1913, the horse wagons were operated at a cost of 33 cents a delivery, which was very large, being due to weather and other conditions, but in April this had been materially decreased, one wagon showing 86 per cent. efficiency and a record of 24 cents a delivery.

Considering the work of horse wagons in May,

these showed a mileage cost of 31 cents and a delivery cost of 26.5 cents, which will indicate that the increase of temperature was having a material effect. During this same month one of the electric wagons was driven 910 miles, an average of 35 daily, at a cost of 20.5 cents a mile, and it made 949 deliveries at a cost of 19.5 cents each. This expense would be, according to estimate, and which figure was afterward verified by actual experience, 17.5 cents a delivery if the equipment were housed in a garage maintained by the company. Another electric vehicle of the same type was, during May, driven 1133 miles, an average of 44 miles daily, at a cost of 17.66 cents a mile, and 1083 deliveries were made at a cost of 17.5 cents a delivery. According to estimate made as before stated the expense would have been 16.75 cents a delivery if the machine had been maintained in the company's garage.

Regarding these figures from another aspect for a moment the following comparison will be especially interesting:

April, 1912.

Electric Wagon	Monthly Mileage	Daily Mileage	Operating Cost Average a Mile	Deliveries During Month	Average Cost of Delivery
1	910	35	21.125 cents	1057	18.20 cents
2	1036	40	19.500 cents	1147	17.25 cents

Efficiency of wagon No. 2, 94 per cent.

Estimate of delivery cost of wagon No. 2, if maintained in company's garage, 15.5 cents.

Horse Wagon					
	650	25	26 cents	701	24 cents

Efficiency of horse wagon, 86 per cent.

May, 1913.

Electric Wagon					
1	910	35	20.50 cents	949	19.5 cents
2	1133	44	17.66 cents	1083	17.5 cents
Horse Wagon					
	520	..	31.00 cents	615	26.5 cents

Estimate of delivery cost of wagon No. 1 if maintained in company's garage, 17.5 cents.

Estimate of delivery cost of wagon No. 2 if maintained in company's garage, 16.75 cents.

Respecting Electric Machines.

During the past year four electric wagons have been purchased and a portion of the company's stable has been transformed into a garage for their maintenance. A switchboard from which 12 machines can be charged simultaneously has been installed, and this has placed the use of the machines on the same basis as the horses; that is, they have been maintained at the fullest economy. The average cost of delivery by the animals is fixed at from 25 to 27 cents for each delivery made, and the average cost of delivery by electric machines has been fixed at 17 cents, or approximately 66 per cent. less than with horses.

It will be remembered that this is under expert administration and with the same supervision, so that it may be stated that the results obtained represent the same quality of efficiency with each type of equipment. The records are kept by the same people, and there is no doubt of the endeavor to work the wagons to their fullest capacity. The horse wagon mileage is high, which would not be possible without extra animals, there being one and a quarter horses used for each. Without reserve horses the mileage would probably shrink at least a third.

The statement relative to the efficiency of the electric machines is seemingly better than has been stated in the opinion of Mr. Waltermyre, for he is of record in stating that the delivery cost has been reduced about 40 per cent. through their use, the maintenance compared with a two-horse wagon, and that they show an efficiency of better than 90 per cent.

This is a striking example of the possibilities of motorized delivery service and of the value of high class organization and administration. The economies have been demonstrated without question, and in work where the horses would be most productive. But it should be remembered that this was accomplished by an expert. Men with similar training could no doubt do equally well with other transportation installations.

MOTOR TRACTOR TESTS AT TUNIS.

April 15-22, 1914, is the period named for the competitions for all forms of motor driven agricultural machinery, tractors, motor trucks, motors, and the like, which has been organized under the direction of the government of Tunis, Africa, and which will be open to all machines and vehicles driven by steam, electric and internal combustion engines. The announcement is made that the prizes offered will aggregate about $6000, and in addition all exhibits entered will be relieved of import duty and the government will provide free all fuel that will be needed in carrying out the tests. The general conditions are stated in a booklet entitled "Concours de Motoculture". American manufacturers who desire to enter machines in the competition are invited to send their names to the Direction Generale de l'Agricultura, 76, Boulevard Bab-Benet, Tunis, North Africa, before Dec. 31, 1913. Those entering in the competition are required to each make a payment of $10, which will be returned to the entrants when the exhibits are received at Tunis.

The Evans Motor Car Company, Nashville, Tenn., is to build a plant on the banks of the Cumberland river, near that city, for the construction of pleasure cars and service wagons. The plant will include three buildings, each 300 by 50 feet, of reinforced concrete fireproof construction, and will be equipped for the services of from 500 to 600 employees.

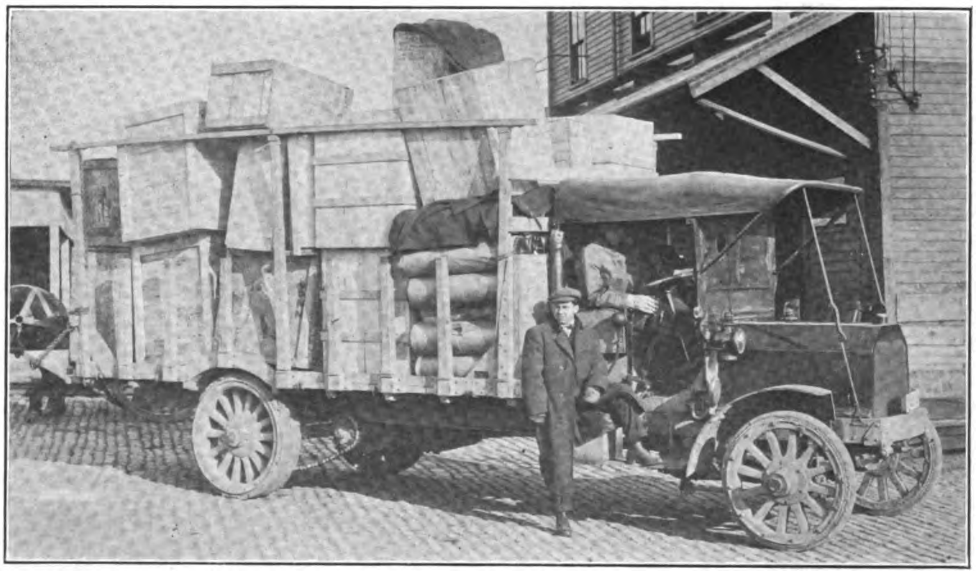
The Milwaukee Motor Company's plant, Milwaukee, Wis., which was bought at a receiver's sale by the Chicago House Wrecking Company, is to be operated beginning Jan. 1 and will afford employment at first to 100 men. The purpose of the purchasers is to develop the business and when it is profitable to dispose of it. The factory has been closed for more than six months. The price paid was $86,000.

COMPETING WITH RAILROADS WITH TRUCKS.

Mill Managers Favor Motor Service Between Plants and Shipping Terminals, Either Long or Short Hauls, for Quick and Certain Deliveries and Minimized Handling.

THE expense of transportation by railroad has constantly increased, and, even with rates regarded as extremely excessive by the shipper, the upward tendency of freight charges can be expected so long as private ownership continues, and the demands for dividends by stockholders and greater wages by organized labor continue. Where railroads compete the conditions are oppressive for industry and commerce, for transportation cost, when added to the expense of production, is just as effective a barrier to industrial and agricultural marketing as is a tariff tax, but when a monopoly exists, as in the event of a single railroad service, as is often experienced in the West and in New England, the only limit to charges is the schedule the Interstate Commerce Commission will approve.

In railroad haulage handling is a considerable item of cost, in addition to the regular transportation charges, and this expense must be added to the freight rate. The carriage from the place of production to the railroad terminal, and from the freight house to the purchaser, is usually divided between the buyer and the manufacturer, and the freightage is paid by either the one or the other. But whoever pays, those charges are in turn included in the selling price, and the public eventually settles for every transportation charge.



Providence & Woonsocket Express Company's Three-Ton Peerless Truck Arriving at Dock of the Merchants' & Miners' Line, Providence, with a Typical Load of Freight from Woonsocket Mills.

It is evident that no matter the distance of shipment there will be comparatively little change in the cost of handling, that is, in the highway haulage expense, but it will be a greater proportion of the total with the decrease of distance. The railroads haul loaded cars between stated points and receive and deliver freight at regular terminals. No matter how fast the trains are operated, the shipping is made at regular intervals, and with passenger service given precedence the freights are generally delayed. Not only this, those shipping and receiving the goods must maintain highway transportation equipment, or pay for haulage.

Gives Better Service Than Railroad.

Summarized we find that there are numerous factors for high cost, delay, the use of expensive service, and there is every reason why there should be utilization of what will lessen expense, expedite shipment and eliminate the expense of individual transportation facilities. There is undoubtedly a limitation as to the distance that motor vehicles can be used advantageously, but what this may be is dependent upon conditions that may vary in every locality. An illustration of the possibilities is the service of the Providence & Woonsocket Express Company, which has been established a year, and which has been successful in developing business in competition with the New Haven railroad system. This company operates three Peerless trucks between Providence and Woonsocket, R. I., a distance of 16 miles between the geographical centres of the two cities, and the business has been so developed that loads are carried each way, there seldom being a trip that a machine has less than its rated capacity. As a matter of fact it may be said that practically every mile the trucks are driven they carry freight.

The company does not do what may be understood as an "express" business, that is, in collecting and delivering packages or cases to or from customers, giving regular or intermittent service. It may be regarded as the contractor for the freightage of a number of mills of considerable size—some of them being very large—between the two cities. To better understand the conditions obtaining it should be known that the New Haven road receives freight at Providence for Woonsocket, or at Woonsocket for Providence, and under ordinary circumstances undertakes to have the cars at the destination the same day as the shipments are received, up to the time limit set. But the cars must be placed in the yards and the usual records made, notifications given, and the goods placed in the freight houses if in less than carloads. If the cars are fully loaded they may be run to the sidings of the

mills, if they have spur tracks, or located where they can be reached.

Special Delivery in Fast Time.

The time required for delivery depends upon varying conditions, but four hours is considered to be the least that can be allowed, and at times this is extended to 24 to 48 hours through traffic congestion. The mills ship to different points by water from Providence, to New York, Philadelphia, Baltimore and elsewhere, and there is the railroad haul between Woonsocket and Providence, with a high rate, the delay that may be caused if delivery is not made to the piers before the sailing times, and the demands of customers to be considered. The railroad yard at Woonsocket, which is scattered in six different localities, is being consolidated at a point a mile or more from the centre of the city, and this means the haulage of goods will be increased very greatly.

Some of the Woonsocket mills use yarn that is spun at Olneyville, a suburb of Providence, and this must either be shipped by freight or hauled, and this material is used constantly. Besides this all use supplies that are sent from other points and received at Providence. This condition existed when the company first inaugurated its contract work a year ago with one Peerless motor truck. The Olneyville mills receive water shipments from New York and other ports, which are preferable because of quick service as compared with the railroads, and the haulage of these freights was first undertaken, and with this work the transportation of goods from the mills to the piers. Later on the mill managers proposed making trips over the roads to Woonsocket.

Shipment of Mill Products Hauled from Plants Near Providence Ready for Delivery at the No. 3 Freight House of the New Haven Road, a Part of the Service of the Providence & Woonsocket Express Company.

The company tried out the work and it was found that two round trips could be made, this requiring from 65 to 70 miles driving daily, and that a "tailboard delivery" could be made at the mills and piers, eliminating the need of haulage by the mills at either end. For this the rates charged could be different than paid to the railroad, because of the additional advantage of no lost time. Four months later the second machine was added, and about three months ago the third truck was bought, and all three are now worked to capacity despite the business conditions.

A typical day's work for a truck and a crew of a driver and two helpers is to go to a steamer pier and collect the freight for several Olneyville mills, hauling this from three to four miles and delivering, and then taking on a load for Woonsocket. The trip to Woonsocket is made in about 1.5 hours in average conditions and the load is delivered. Then another load is taken on and this is taken to Providence and delivered at a pier, and then a second load is taken from the Olneyville mills to Woonsocket, and another freight taken on, which is left at a Providence pier before the hour for closing of receiving. The actual time on the road between the two cities will average six hours daily, and the loading and unloading is done quickly by the crew. The collection of the loads at Woonsocket may require an hour each trip, but often less time is necessary, and unloading is frequently done in from 10 to 15 minutes.

Co-Operation by the Customers.

Thomas Sullivan is manager of the company and he believes in the economy of the time of the machines, which is secured by having men enough to handle the freights quickly, and he has the co-operation of the mills to the extent of having the goods in readiness at stated times, so that there shall be little or no delay. An operating schedule is maintained for each driver and this is carefully observed. With the use of the trucks the mill managers can depend upon receiving material or other freight practically at the times fixed, and should there be reason additional trips are made. The greatest mileage of any one day has been approximately 125, and freight was carried nearly all this distance.

The purpose is to afford the customers what may be regarded as an express service by road vehicle, delivery often being made in less than two hours between the two cities, this minimizing records, saving in time and in investment in equipment, and justifying a charge that can be larger than what would be made by the railroad, and yet decidedly economical when every consideration is weighed. The quick trips are worth more to the mills were there no other saving, and with the other factors of material importance it will be understood why the mills have preferred to have this service.

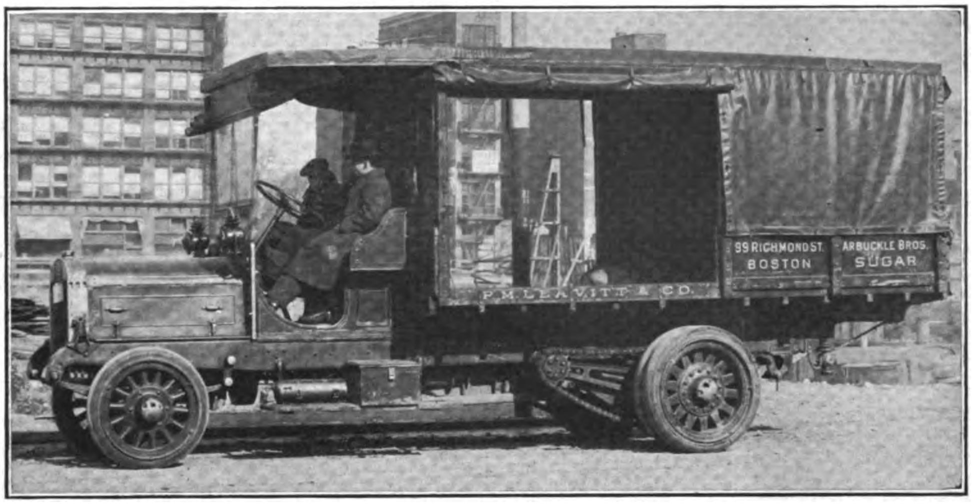
The trucks are fitted with special platform bodies with wheel housings built into the decks, with stakes and frames at the sides so that loads of large bulk can be carried safely roped. The platforms have length

of 16 feet and width of seven feet, and there is the tailboard width that can be utilized when necessary. The frames also support tarpaulin covers, so that the loads may be amply protected in the event of storm.

Trucks Carefully Operated.

Manager Sullivan is extremely careful as to the attention the machines shall receive. The trucks are inspected weekly at the Peerless service station and kept in excellent condition, while they are gone over carefully by the drivers each day. Nothing is neglected for the business is dependent upon the machines being constantly operative. After a year's experience with the company the customers have learned to rely upon it, and the coming spring a garage will be established in a building originally built for a stable, and it is probable that more trucks will be bought and the service materially increased.

The railroad company has sought to retain its business in Woonsocket, offering to ship special cars in very quick time, and making proposals for improving its service, but it has not been possible for it to go beyond the limitations of railroad facilities, and it can neither collect nor deliver goods, nor equal the time of delivery made by the trucks. The mill managers are willing to co-operate with any proposition that will benefit themselves, and they are aware that their requirements are immediately considered and, so far as possible, provided for by the management of the express company, while they have to take what the railroad is disposed to grant, no matter what the effect upon them from a business viewpoint. This is a condition that has brought about the development of successful competition with trucks with the railroad, and the example can be made the most of by others wherever railroad domination over business obtains.



Seven-Ton Vulcan Truck Used for the Delivery of Sugar by P. M. Leavitt & Co., Boston, Mass., to Suburban Customers.

The Hood Rubber Company, Watertown, Mass., maker of Hood truck and Shawmut pleasure car tires, has increased its capital from $2,500,000 to $3,500,000 by the issuance of $1,000,000 preferred stock, which is to be sold at not less than par whenever in the opinion of the directors such sale is desirable.

RECEIVERS FOR ATLANTIC VEHICLE CO.

Well Known Maker of Electric Machines Handicapped by Lack of Capital.

The directorate of the Atlantic Vehicle Company, with factory at Newark, N. J., and executive offices at 1600 Broadway, New York City, made petition through Vice President Ralph Sanger for appointment of receivers to the United States district court at Newark, N. J., which petition was granted Nov. 11, and A. Perry Osborne of New York and Harry L. Davisson of East Orange, N. J., were appointed by the court to administer the affairs of the company.

The company was organized early in 1912 with capital of $100,000, with McKinley Boyle as president, Ralph Sanger as vice president, Arthur J. Slade as chief engineer and Herbert L. Satterlee as general counsel. The vehicles built by the company were designed by Mr. Slade and have a high standard for efficiency, and because of the quality of material and the workmanship have commanded prices above the general average for machines of similar capacity. The company established a plant at Newark that is admirably equipped and has a capacity of about 200 wagons and trucks annually and it confined its sales activities to New England and the East.

The cost of the factory and the initial promotion has been large and the need of capital to meet the demands incidental to development has been keenly felt for a number of months. To continue the business on a sound basis additional investment had become necessary, and as obtaining new capital was extremely difficult because of the disturbed condition of business and finance, the officials of the company believed that the interests of the stockholders and the creditors could best be served by the appointment of receivers. This decision will insure the continuance of the business until plans for the future can be developed and allow the completion of the orders on hand.

Because several rates of taxation are provided for by the new Michigan automobile registration law, which will become effective Jan. 1, and is not uniform in its effects, an endeavor is to be made by organizations of motorists of that state to have it declared unconstitutional. A test case is now being prepared.

A show of service wagons and trucks will take place at Cincinnati, O., in Music Hall, March 2-4, and will be conducted by the Cincinnati Automobile Dealers' Association.

TRUCKS DEVELOP WHOLESALE GROCERY TRADE.

BUSINESS economy may be established from many viewpoints, and when delivery must be made promptly and patronage can be increased by quick service, even if the expense of transportation is not relatively lessened, there is no doubt of the greater profits that may be secured. This statement is made to emphasize that it is not always possible to demonstrate economy in ton-mile cost, in rates charged, or in prices paid, but volume of transactions may be the actual measure.

A case in point is that of the Woonsocket Wholesale Grocery Company, Woonsocket, R. I., which has, through the use of motor wagons, not only increased the area in which it transacts business, but has stimulated its out-of-town trade to such an extent that President Frank W. Holden says, without question, that he would not know how to do business with horses, by this meaning that he has found the machines to be of extreme value to him.

Woonsocket, with a population of about 40,000 people, is but 16 miles from Providence, the second city in population of New England, and despite this fact it is a commercial centre of material consequence. New England cities may be comparatively short distances apart and connected by railroads, trolley lines and excellent highways, but each attracts business from a surrounding territory that would, in the minds of those not familiar with the conditions which exist, seemingly be drawn to a larger city.

Two-Ton KisselKar Wagon in the Service of the Woonsocket Wholesale Grocery Company, Woonsocket, R. I.

Woonsocket draws largely from the towns located north and west for a distance of at least 15 miles, and for about 10 miles east and six miles south, there being numerous manufacturing communities that have populations ranging from a few hundred to 6000 or 7000 people, and this company has developed business of considerable proportions with store keepers. One reason is that prices can be quoted that will be at parity with those of houses more distant, the delivery can be made more quickly, and if the customer pays the freightage this is relatively less.

The company's salesmen regularly visit the villages and towns and solicit business, and usually purchases are made sufficient to meet expected custom. Occasionally special orders are given by telephone. Up to March, 1912, the company made deliveries in Woonsocket by horse wagons and all out-of-town orders were sent by freight or express. Purchasing by the customers out of the city was done with expectation of more or less delay, and sufficient time to permit delivery was necessary. This was not a hardship in one sense, but orders were occasionally sent to other concerns because there would be but little more time required, and because of the time required the company could not develop business that seemed possible. The company bought a two-ton KisselKar wagon in March, 1912, and with this planned to make delivery outside of the city, and to utilize it in short hauls when not required for the town delivery. Regular days were fixed for visiting different localities and the salesmen emphasized that within a comparatively short time, two hours or less, after receiving orders on these days, delivery could be made direct to the stores.

From the viewpoint of the company this was a saving of time in packing, for the goods could be carried without preparation as when sent by freight or express. The hauling to the freight house or express office was eliminated, and the customers had the advantage of receiving the shipments directly at the stores instead of doing their own haulage, or hiring others to do this work. Besides this, the goods were received in better condition as a rule and the unpacking was simplified. Then in the event of emergency a special order could be received in a few hours and a stock brought up to standard.

The advantage of buying where there was a distinct saving was quickly apparent to the customers and the orders began to increase. It was possible to go to points that were formerly difficult to serve because of the limited means of transportation, and to serve the stores in remote sections as well as those close at hand. In August, 1912, a ton KisselKar wagon was ordered, and since that time both machines have been used regularly. Perhaps an illustration of a single afternoon's delivery between Woonsocket and Pascoag will serve. Previous to the use of the machines if the orders sent to this route weighed a ton business was up to standard, but five tons of goods

were sent out to the customers a few days since, this requiring the machines to make three trips.

This is a fair example of the development of the out-of-town patronage, and it has constantly increased. The expectations are that by next spring another machine will be needed. The wagons are used for city haulage, and while this is practically no economy in the mind of President Holden, it is certainly not an extravagance. The cost of delivery is, Mr. Holden says, perhaps not largely reduced, but the business has been so largely developed by motor equipment that he will consider no other means of haulage. The wagons are economically kept. They are stored in Mr. Holden's private garage and they are driven by careful, experienced men. They are required to keep the machines in good condition and each man is allowed a half day a week to work on the one he drives. Fast driving and overloading is guarded against and neither wagon has been out of service because of accident or failure. Unusually good results have been obtained with tires. The two-ton machine was driven 14,000 miles before the rear tires were renewed, and the front shoes are still in use and will probably last to the end of the second year. The ton wagon was originally fitted with pneumatic tires, but about three months ago those on the rear wheels were replaced by solid shoes that have thus far given excellent satisfaction.

Ton KisselKar Wagon Used by the Woonsocket Wholesale Grocery Company, Woonsocket, R. I.

The wagons are driven largely over country roads and with good loads. The longest single delivery trip is about 35 miles, and the shortest is about 20 miles, but these are route distances and are usually covered unless a special delivery is being made. The company has a spur track at its warehouse and carload shipments are received direct, but when the receipts are smaller it is necessary to haul these from the freight yards. Both machines are worked with two men when doing route delivery, and the loading is by as many as can work conveniently at the warehouse, so that time is economized. Usually less than five hours is required to make deliveries on the 35-mile route, and considering the handling and the numerous stops what may be regarded as fast time is made.

PITTSBURG SHOW, FEB. 14-21.

Fourth Annual Event Will Include Pleasure and Commercial Cars.

The Pittsburg Auto Show Association has completed arrangements for its fourth annual show, which will be held Feb. 14 to 21 inclusive. Pleasure and commercial vehicles will be exhibited, and the display will be known as the Big Exposition Auto Show. The officers of the Pittsburg Auto Association are as follows: President, Aaron DeRoy; vice president, J. Casper; secretary, J. D. White; treasurer, E. A. Williams; board of directors, A. A. Buhl, C. C. Laughner, W. M. Laird, R. D. McCurdy and Elias Lange. J. H. Zimmerman is show manager and headquarters have been established at 130 North Highland avenue.

STUDEBAKER OFFICERS.

A. B. Erskine, who was treasurer of the Studebaker Corporation and stationed at Detroit, Mich., has been named vice president of the company and will continue the duties of both offices. James G. Heaslet has been made chief engineer and vice president in charge of engineering and production. Ernest R. Benson is now sales manager and vice president in charge of the distribution of the vehicles produced. Arthur L. Philip is made assistant sales manager, in charge of the motor car division. Charles D. Fleming is made assistant treasurer and H. E. Dalton is made general auditor, these being general promotions.

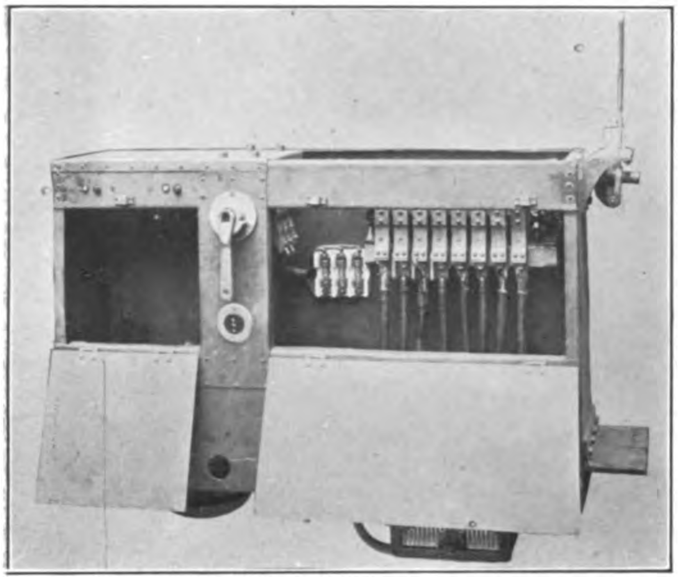
The new buildings at the plant of the Edison Storage Battery Company, Orange, N. J., are now complete and in readiness for the installation of the machinery, which is now being delivered. It is expected that by the first of the year the factories will be ready for production, and for their operation more than 2000 persons will be required.

R. M. Benn, formerly connected with Claire L. Barnes & Co., of Chicago, Detroit and Cleveland, O., has been made sales manager of the Lefever Arms Company, Syracuse, N. Y., which is engaged in the manufacture of vehicle parts.

Having outgrown its present branch at 918 Pike street, Seattle, Wash., the Firestone Tire & Rubber Company has decided to establish a branch and service station in that city and will erect a building with 20,000 square feet of floor surface to house it.

IMPROVED GENERAL VEHICLE MACHINES.

THE General Vehicle Company, Long Island City, N. Y., builder of General Vehicle wagons and trucks, has incorporated in the designs of machines



The New General Vehicle Controller Box, Showing the Lamp Circuits Beside the Controller, with the Three-Way Drum Type Running Switch, and Under This the Plug for a Portable Lamp.

that it will produce hereafter a number of refinements or improvements, these being such as will afford greater satisfaction for the owner and the operator, and they will not in any way change constructions that have been found to be practical and enduring. The General Vehicle machines were standardized in 1907 and have been continued since that time without change, and in the refinements that have been made no departure was taken from what has been proven by time and service.

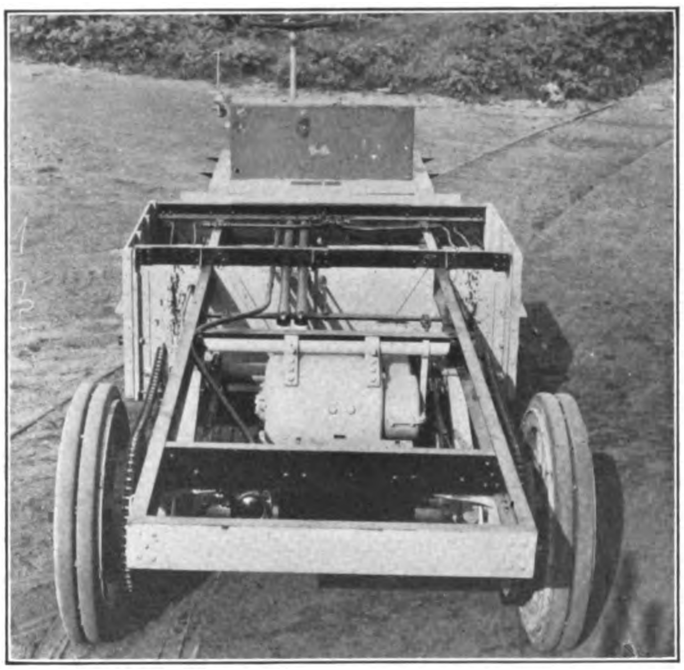
The 1000-pound worm-driven machine will be built as it was first displayed at New York, but the refinements stated will be applied to all the six sizes of machines produced, aside from the addition of a second brake, which will be installed on the two, 3.5 and five-ton trucks.

The first of these is the use of metal conduits for the protection of the power wiring, which will extend from the motors forward above the battery boxes, and to the controller boxes. In previous productions the power wiring from the batteries to the motors and forward to the controllers was carried in channels of substantial wooden stringers that were mounted on the cross frame members, and the wires were secured by porcelain clips attached to the stringers. While this construction afforded accessibility and endured satisfactorily, there was a possibility of damage to the insulation and complications arising from saturation by acid or water.

In the place of the channelled wooden stringer and the exposed wiring two metal conduits are carried from the motor to the controller box, which are secured to the cross frame members and have the support of the ends of the battery box. These carry the power wiring, so that it is protected in every way from damage, and should there be occasion any lead can be replaced in a very short time without removing the body. Installed in this manner there should be no reason why power wiring should not endure for the entire life of the machines.

The General Vehicle wagons and trucks have always been equipped with an ample brake operating in large drums on the rear wheels, actuated by a pedal. The design of the 4000, 7000 and 10,000-pound machines continues this brake for general use in operation, and a second brake of the contracting band type operating on drums mounted on the jackshaft between the sprockets and the chassis frame through a pedal, has been installed for emergency service. This second brake gives what may be regarded as absolute control under any circumstances, and eliminates the use of the controller for regulating speed when descending grades, which has been resorted to by some drivers, which, if the driver were inexperienced or careless, might result in damage of the controller, battery or motor.

The controller boxes are now constructed of sheet metal, these serving as the seat. These boxes are divided into two compartments, the larger of which contains the controller. As made, these boxes have hinged doors at the front which effectually protect against moisture and dust. In the controller com-



Refinement of General Vehicle Chassis, Including the Emergency Brake on the Jackshaft, the Rigid Metal Conduits for the Power Wiring and a Sheet Steel Tool Box Beneath the Motor.

partment are installed the terminals of the lamp circuits so that cartridge fuses may be used, instead of open fuses, these being a safeguard against fire and protect-

ing the mechanic who may have cause to replace them. The smaller compartment may be used for the storage of small articles of equipment that may be required.

Mounted on the controller box between the two doors is a three-way drum type cut-off switch that eliminates any possibility of the machine being started when it is being charged, and a mechanic can work on the controller during the charging of the battery. By removing the switch handle the driver can leave the machine "dead", so that it cannot be started during an absence, thus protecting the vehicle and insuring it against theft or accidental starting. Below this switch is a plug receptacle, by which a portable lamp may be quickly connected by the driver for work on the road or by a mechanic while in a garage, instead of using a head or tail lamp. Under the rear of the chassis frame is installed a large sheet steel tool box, which is lighted by the tail lamp, and tools can be quickly obtained whenever desired at night. In addition to this all of the spring shackle bolts are provided with ample grease cups, which, through thorough lubrication of the springs, shackles and bolts, will insure the fullest action and extreme endurance of these parts.

THE DETROIT FENDER.

The enactment of municipal ordinances requiring the equipment of service wagons with fenders that will protect the public has directed the attention of the owners and users of such vehicles to the possibilities of fender equipment. Naturally this attitude of the municipal authorities has stimulated invention, and the Detroit Fender Company has been organized at Detroit, Mich., to construct equipment that will meet the requirements of all local ordinances.

The Detroit fender is built with two sections, each formed of heavy tubing, the frames being filled with a large mesh wire grating or netting. A steel arm is attached to each spring horn, being supported by bolts through the horns and the spring eyes. At the ends the arms are formed so that they parallel the ground, and to these ends are fixed the footboard or "scoop" of the fender, which is normally carried about six inches above the roadway. The spring horns and the chassis frame serve as the mounts for the lower ends of two members that are united and form triangular brackets which support the upper half or section of the fender.

The top portion of the fender is pivoted on these brackets so that it may be lifted from the bottom and folded back against the radiator, this being lifted when the driver wishes to reach the engine crank. The forward members of the brackets support and brace the fender when the top section is dropped. The lower corners of the top half of the fender are braced with diagonals, this considerably strengthening it.

The upper ends of the arms supporting the lower section extend above the spring horns and to one of these is attached a rod that is carried back to the side of the dash at either the right or left. The rod is placed at an angle and by a direct pull on it the driver may lift the fender six inches above the normal height if necessary to clear an obstruction. The lower half of the fender can be lifted and folded against the upper part while in a garage, so that the machine can be worked in the usual space without possibility of damage. The weight of the equipment as installed is approximately 75 pounds. As the fender covers each wheel while the truck is moving directly forward, but does not extend beyond the hub caps, it will be seen that it does not interfere with traffic, yet it affords all the protection that could be required.

KNOWLEDGE MEANS ECONOMY.

President George A. Kissel of the Kissel Motor Car Company, builder of the KisselKar wagons and trucks, after making careful analysis of the prospects for the industry during an extended trip in which he visited his agents in different sections of the country, maintains that there is no question in his mind that the coming year will show the greatest strides in the history of the industry so far as the production of service machines is concerned. He comments:

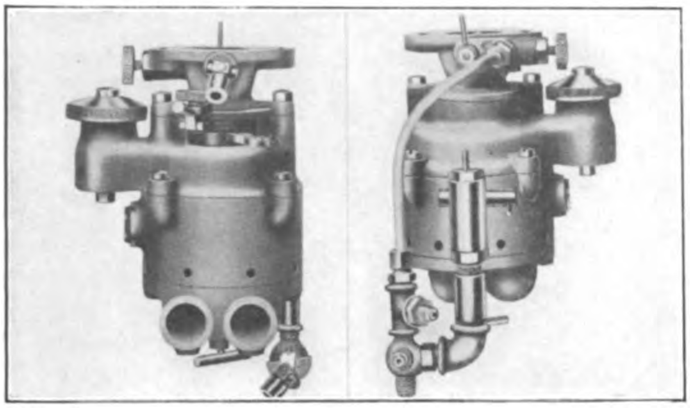
"The truck campaign is just passing out of the educational stage. Trucks have proved themselves in actual service tests covering a period of years, and business men, formerly skeptical, seem now to be thoroughly convinced that to keep up with competitors they must adopt motor delivery. In addition to this, experienced and reliable truck drivers are constantly multiplying, thus obviating a formerly bothersome problem. Gradually, also, improved loading and unloading methods are being adopted to keep trucks moving and thus up to their maximum possibilities. Trucks handled rightly are such an obvious economy over horses, in both time and money, that there is no question regarding their ultimate domination in local and interurban delivery".

The New Orleans postmaster has developed his parcel post distribution service by using trailers with the motor wagons available for this work. The requirements were such that the motor equipment was inadequate and so that there might be no diminution of the delivery animal wagons were fitted with axles built for motor vehicles, and street car drawheads for coupling them to the machines. The trailers have been found to draw easily and the loads can be largely increased, the motor wagons having sufficient power to take them wherever needed and with practically no loss of time.

William H. Stilwell, M. E., who was connected with the sales department of the J. S. Bretz Company, New York City, for a considerable period, has resigned to become sales manager and engineer for Joseph Schaeffers of Cleveland, O., who is importer and distributor of H. C. B. ball bearings, with offices in the Marion building, Cleveland.

THE KNOX MODEL E KEROSENE CARBURETOR.

FOLLOWING exhaustive experimentation covering a period of nearly three years, supplementing an engineering knowledge developed by years of prac-



The Knox Kerosene Carburetor, Showing the Construction from Either Side.

tical work, the Camden Anchor-Rockland Machine Company, Camden, Me., has perfected a carburetor designated as model E, which is designed to use with kerosene fuel in all internal combustion engines. The company has manufactured carburetors more than 12 years and half that time has experimented with kerosene carburetion, the possibilities of economies through the use of that fuel having prompted unusually careful investigation.

The company three years ago, because of the demand from its foreign trade, began the production of a carburetor designed to use either kerosene or gasoline, and in practical service this instrument gave excellent satisfaction. The increasing cost of gasoline and the comparatively smaller price of kerosene prompted further investigation with a view of utilizing the latter fuel constantly, aside from starting, and early in 1911 E. P. Lamb, the company's experimental engineer, began development of a carburetor that would be equally efficient for automobile and tractor motors and stationary and marine engines. The results obtained have been in every way gratifying, and such efficiency has been realized in continued service that the company has made plans for producing the instrument to meet any demand that can be reasonably anticipated.

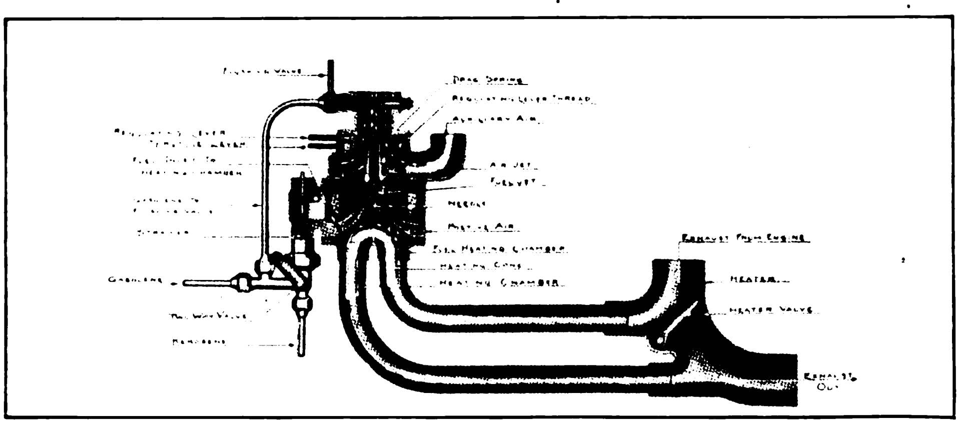
The carburetor is so designed that the engine may be started with gasoline, which insures operation in coldest temperatures, and then kerosene is used that is gassified by heating the base of the instrument from the exhaust. An explanation of the operation of the carburetor is given by the company's engineer as follows:

The fuel is admitted to the carburetor in the usual manner. In the base of the carburetor is a conical shaped heating chamber. The heat is derived from the exhaust line and the temperature is regulated by a damper or valve in the exhaust pipe that is shown in the accompanying illustration. This damper is controlled from the dash. As the chamber in which the fuel is heated is of such capacity that the fuel will flow over the cone, which is made of soft copper and has a large heating surface, no accumulation of kerosene follows and the fuel is transformed to gas as it passes the needle valve, which is maintained to be the only correct method of carburetting kerosene.

The needle valve and the nozzle are peculiar in construction. The gassified fuel passes the regulating needle into the nozzle through a series of very fine holes, and the heated constant air is supplied to the nozzle through a second series of small orifices. The nozzle is so constructed that the fuel holes intersect the constant air holes at the outlet point, a condition that insures atomization of the mixture as it enters the mixing chamber. The needle valve and the nozzle are adjustable and can be raised or lowered by the movement of the throttle lever. The auxiliary valve that controls the additional air supply serves as a throttle. No other control is necessary.

Claims of the Maker.

The qualities of the carburetor, for which special claims are made by the maker, are protected by patents, and these include the method of heating the fuel, the method of increasing the speed of the gases and the method of thoroughly atomizing the mixture. The carburetor is so constructed that either gasoline or kerosene may be used, but for convenience it is built with a flushing valve and the gasoline is not passed through the carburetor. When the motor is first started the fuel is gasoline, supplied by opening the flushing valve, this valve having a needle regulation and being controlled from the dash. After the engine has been run from 15 seconds to three minutes, depending upon conditions, the flushing valve is closed and the kerosene fuel is drawn upon without change in the regulation.



Cross Section of Knox Kerosene Carburetor, Showing the Principles of Operation and the Manner of Heating from the Exhaust.

The maker claims that a gain averaging seven per cent. is made in speed and power when using kerosene, as compared with gasoline, and with practically the same volume of fuel; that further, the standard automobile motors can be operated successfully with kerosene fuel, demonstration of this efficiency leading to extensive tests for some of the motor manufacturers; that when fitted to marine motors the model E carburetor is decidedly superior to the model D instrument, and that in ordinary conditions the marine motor can be started cold with kerosene by priming it well with gasoline. When used with gasoline as fuel the statement is made by the maker that the carburetor, because of its construction and method of vaporizing, will deliver a mixture to the motor superior to that of any other carburetor, increasing the power and decreasing the fuel consumption. The saving with kerosene as fuel instead of gasoline is the difference in price. The company is now building an addition to its plant and has ordered special machinery for the manufacture of these carburetors, and will shortly produce them in standard sizes of one, 1.25 and 1.5 inches, to supply the manufacturers and the trade.

POWER TRUCK COAL DELIVERY

Conditions Experienced by Those Distributing Fuel in New York City.

The conditions governing delivery of coal in New York City and the possibilities of utilizing motor trucks was discussed at the November meeting of the Motor Truck Club. The policy of the organization is to consider the practical experience of men engaged in highway haulage and from the facts developed to determine means of better utilizing motor vehicles, the members profiting through the broadening of their knowledge and the exchange of opinions.

An enormous volume of coal is delivered annually in New York City and its suburbs, and the possibilities for the use of motor equipment appear to be almost unlimited. A very large part of the fuel is delivered during the spring, summer and early autumn, so that for seven months of the year maximum delivery facilities are required, while the remainder of the year the demands are less, being generally to those who cannot store large supplies, in contract deliveries to factories, shops, large buildings, hotels, etc., or emergency orders from families.

Without exception, the experience has been that during the period of the year when the bulk of the coal is hauled the motor trucks have greater efficiency in the larger capacity and greater speed, but during the remainder of the year the earning power is materially lessened. When horses have been used the dealers have rented teams, carts and drivers or engaged in work for others, there being demand for equipment from other businesses, so that the return is generally sufficient to meet expense, and often yields a profit.

The supposition was that the larger investment represented by motorized equipment was such as to hardly justify the purchase of machines, when the limited productiveness during five months of the year was considered, or at least this appeared to be the belief of some of the speakers. That is to say, that some coal dealers believed they could rent horses and secure such return that there would be little or no expense in their keep during the dull portion of the year, and they could hold their help as well. They were doubtful what could be done with motor trucks, although the same renting possibilities seemingly existed, but the matter of body equipment appeared to be the chief obstacle to general use.

This developed the possibilities through having special bodies, and the discussion turned to this subject, there being several body makers present. From this the speakers digressed to the prices for construction of bodies, and the builders pointed out that cost of work that was special and produced with engineering exactness and by skilled workers was necessarily more than where turned out by men who worked by "custom". Instead of being stock productions a truck body must be designed for the chassis on which it is to be used, and must have the strength to endure the service. Stock bodies can be built and kept on hand for delivery whenever required, but special bodies cannot be sold for general work.

The possibilities of building bodies that can be adapted for the requirements of general haulage and yet meet every need in coal haulage was talked over, and the body makers agreed that there was no reason why such equipment could not be supplied. One of the conditions that militate against the greatest economy of trucks being realized is the fact that as a rule the yard facilities have been built for the use of horse vehicles, and that changes necessary could only be made at considerable expense. Delivery cannot be greatly expedited because the handling of coal is incidental to other considerations. The greatest saving must be made in loading, in speed, and in greater carrying capacity, and where these can be combined the results are very satisfactory.

The Archibald Wheel Company, Lawrence, Mass., a concern well known to the motor vehicle industry as producing high class products, has been reincorporated with capital of $800,000 under Massachusetts law by F. N. Andrew, E. H. and I. M. Archibald, all of Lawrence.

C. F. Krueger, who was vice president of the Standard Electric Company, Jackson, Mich., has become associated with the Tiffany Electric Car Company, Pontiac, Mich. The Tiffany company is preparing to produce a low priced electric service wagon.

The advertising department of the Chase Motor Truck Company, Syracuse, N. Y., is now in charge of Mawee Lake, formerly of the St. Louis Republic, who succeeded Robert M. Barber.

COMBINATION SERVICE TRUCK.

Peerless Machine with Changeable Equipment an Economy in Municipal Work.

A Peerless three-ton truck is now in use in the health and street departments of the city of Boston, and after a service that has demonstrated the practicality of the equipment it has been found to be a decided economy. The saving possible with the machine has proven the wisdom of its installation, and it is not improbable that others will be purchased to replace animal vehicles that are now in use, for the truck now does the work for which several special carts would be required in summer and as many more in winter.

The chassis fitted with a dumping body and power hoist was bought with the intention of using this whenever desired, and because of the needs of the health department this was first utilized for the collection of ashes, refuse and garbage, but as the machine was primarily intended for the street department an additional equipment was procured. This consisted of a 900-gallon steel tank and as the highways must be inch hose may be coupled, and the pump will force a stream a considerable distance. This equipment is used in extinguishing fires at some distance from hydrants, and a stream of water may be forced to the roof of a four-story house. Primarily the purpose of the hose as utilized was fighting dump fires.

A three-way valve is included in the pump fitting so that the pump may be used to fill the tank with oil from a car at a railroad siding, a work formerly done with hand pumps when horse drawn oil tank wagons were used. The tank has a large manhole by which it may be cleaned. As now utilized the wagon can be used for either watering or oiling with practically no change. When distributing water the machine is driven 12 miles an hour and does the work for which three horse tank wagons were required. Then, one man, the driver, operates the machine. When spreading oil the truck is driven eight miles an hour and will spread a load of 900 gallons on 12,500 square yards of surface at a pressure of 45 pounds in 18 minutes, equalling a work for which six horses were used. After the watering and oiling has been discontinued for the year the tank and pumping apparatus is removed and

Peerless Truck Chassis and the Equipment Used at Boston for the Highway Department a Part of the Year and the Health Department Another.

oiled or sprinkled a rotary pump was installed to afford such pressure as will give equal distribution of both oil and water.

The tank is carried on a cradle of angle steel and connection is made with systems of piping so that when desired oil may be forced under a predetermined pressure through a header carried directly beneath the end of the tank. The flow of the oil is controlled by a lever that is operated by a man who is carried on a seat mounted on a frame behind the tank, and by this lever the quantity of oil distributed can be governed to meet any requirement, no matter what the speed of the machine. The pump will cause an even pressure in the tank, no matter what the height of the content. For water sprinkling a larger curved header that is mounted back of the oil header is used and the temporary seat for the operator is removed. The oil can be spread over a width of six feet with a direct downward flow, but the water is more widely distributed, covering a path about twice as wide as when used for oiling.

The water outlet from the tank to the header may be closed and another outlet utilized to which a two- with the dumping body the machine is driven 40 miles a day, making collection of refuse and ashes, doing the work of four horse drawn carts.

The H. W. Johns-Manville Company has contracted to distribute the Jones speedometers, odometers and recorders for pleasure vehicles and service wagons, and it is the intention of the company to establish well equipped stations in all localities essential to giving owners of Jones instruments immediate service or adjustments. The Jones instruments will be marketed through the 49 branches of the Johns-Manville Company and will have the personal attention of its 589 managers and travelling representatives. At these branches stations will be maintained, each in charge of a mechanic familiar with speedometer construction, and repair parts will be carried in stock. Any instrument found defective in workmanship or material will be replaced. The stations will be ready for business early in January. The Jones productions will be manufactured under the personal supervision of Joseph W. Jones, the inventor.

LEGAL ASPECTS OF FENDER ORDINANCES.

WITHIN a comparatively short time ordinances have been enacted in several cities, including Chicago and Detroit, requiring that motor service wagons and trucks be equipped with fenders. Some of these exempt vehicles carrying less than 1500 pounds, and generally provisions are made that such fenders must meet with the approval of officials entrusted with the duty of enforcing the regulations.

The question of liability of the owner and driver has always been more or less uncertain, and usually insurance that will protect the owner in the event of suit for damages arising from accident is carried. Generally this insurance covers litigation from personal injury, but in some instances it covers damages to property. The interests of the owner, the driver and the insurance company are alike in these ordinances, wherever they are effective.

Not a little attention has been given to the subject in Detroit, Mich., and with the purpose of informing the people generally of the value of the regulation in that city, and of their rights, at the request of the Wolverine Automobile Club, Attorney Cornelius T. Myers wrote the following opinion in prediction relative to the fender ordinance. This commentary is generally applicable. Incidentally, it may be said that the ordinance is being stringently enforced.

Attorney Myers' Opinion.

On Oct. 1 the police department was called upon to enforce the motor truck fender ordinance. This ordinance specifies that all trucks of one-ton capacity and over shall be equipped with a fender approved by the police department. The object of the ordinance is to prevent accidents to pedestrians, which accidents have been far too numerous of late. Several fenders have been presented to the police department and are offered for sale to our citizens who operate trucks. They resemble the various types of trolley car fenders, with which everyone is familiar.

Two questions now confront us. (1) If a truck equipped with a fender strikes and injures a pedestrian, can the owner of the truck offer as a defense the fact that he had complied with the law and the pedestrian was taking an ordinary risk? (2) Will the fenders prevent accidents?

Results from Fitting Fenders.

On the first point: It is only natural that, having been compelled by law to invest money in a fender, an owner can point to the fact that he had done all expected of him. The driver will certainly not be more careful, for he feels that having a fender to a certain extent absolves him from responsibility for an accident; also, that with a fender he has a chance of striking a person and not injuring him.

On the second point: The only thing a fender, such as can be purchased, will do, is in some cases to prevent a pedestrian being run over by the wheels themselves. Now, in the vast majority of cases the victim is injured by being struck by some part of the truck, such as the frame, mudguards, radiator or lamps (if they are on front of the truck), and thrown to the pavement or against some nearby object. With a fender attached, other things being equal, the pedestrian stands more chance of being struck because the fenders extend a foot or more ahead of the truck itself. The edge of the fender is only six inches above the pavement, so that if a person is struck with any force, he is likely to have his legs knocked from under him and thrown more violently than ever against the pavement or some part of the truck.

Causes for Accidents.

The causes of most truck accidents are fast or careless driving, ineffective brakes and (with pneumatic tired trucks) the failure to use skid chains when necessary. No amount of fenders will offset these conditions. The fender makes a heavy vehicle still more cumbersome, and adds an item of expense to the already heavy cost of hauling goods. In some cases it will be of service, and no attempt is being made to deny what usefulness it has or the public spirit that prompted the passing of the ordinance. The cure for the epidemic of accidents is deeper than the adoption of a fender. The cow catcher does not help the unfortunate New Englander who is struck by a New Haven railroad locomotive, and on the other hand, the fenders of the Detroit United Railway are seldom called upon to make a rescue. It is all a question of handling. The cow catcher is out of date and useless when called upon; the trolley fender is one of the best of its kind, but very seldom called upon. Bad management leaves railroad crossings unprotected; hence the disaster. Careful engineering has provided a safe, maximum speed and an efficient brake for the trolley car and careful training has given the motorman judgment in its control; hence the comparative absence of accidents here.

Conditions to Be Overcome.

The motor truck is comparatively a new machine and the average driver has had none too great a training in its control —neither does he fully appreciate the great forces which he is handling. Very often the truck itself is at fault, either in the design of some of its parts or in their adjustment. Heavy weights travelling at undue speeds are very hard to stop quickly without straining the mechanism or damaging expensive tires—therefore limit the speed by law and see that the governing device will not allow any greater speed. Brakes wear even when well designed and I have been on many a truck in this city where the brakes were in such poor condition as to be of almost no assistance in stopping the truck. I have seen more than one driver go day after day depending on his horn to clear the way, on nice judgment in avoiding grades, and on the other fellow's brakes to prevent a collision. Every truck should be required by law to be able to stop in a given distance when loaded to its maximum capacity.

If an ordinance is passed covering reasonable maximum speeds and stopping distances for trucks of various sizes, I think rapid progress could be made in doing away with accidents. Make inspections at given intervals, and whenever an accident takes place, have an inspection made on the spot. It should be kept in mind that nothing should be done to harm motor truck traffic, because it is of great economic advantage to the city at large, but we should guard against the great risk of accident on our streets during the development of this most modern means of transporting goods.

GENERAL MOTORS DIRECTORS.

The General Motors Company, of which the General Motors Truck Company is a subsidiary organization, will continue for the coming year with practically the same board of directors, and, assumedly, without change of policy, for Nov. 18, at the annual meeting, Joseph Boyer, Emory W. Clarke, W. C. Durant, Robert F. Herrick, J. H. McClement, Edwin D. Metcalf, C. S. Mott, M. J. Murphy, Charles W. Nash, Thomas Neal, Albert Strauss, James J. Storrow, N. L. Tilney and Jacob Wertheim were elected. Of these Robert F. Herrick of Boston was chosen to fill the vacancy caused by the death of Anthony N. Brady, and C. S. Mott, president of the Weston-Mott Company, Flint, Mich., and mayor of that city, succeeded Andrew H. Green, Jr., resigned. Emory W. Clarke was elected a voting trustee as a successor to Anthony N. Brady. The board of directors organized with the election of the following officers: President, C. W. Nash; vice presidents, W. C. Durant and Emory W. Clarke; secretary, Stanley W. Backus; treasurer, James T. Shaw; chairman of the board of directors, Thomas Nash; chairman of the finance committee, James J. Storrow.

Joseph D. Wilkinson of the Smythfield Export Company, Philadelphia, Penn., will sail from San Francisco, Cal., Dec. 12, with a party of 10 that will make a tour of the world exploiting different commercial lines. He will exhibit and demonstrate a Commerce 1000-pound wagon and has contracted for the delivery of 250 of these machines to be delivered at points to be later specified. The party will visit Australia, Asia, Africa, Europe and South America, and expects to be absent two years.

TRUCKS WORKED IN BLIZZARD.

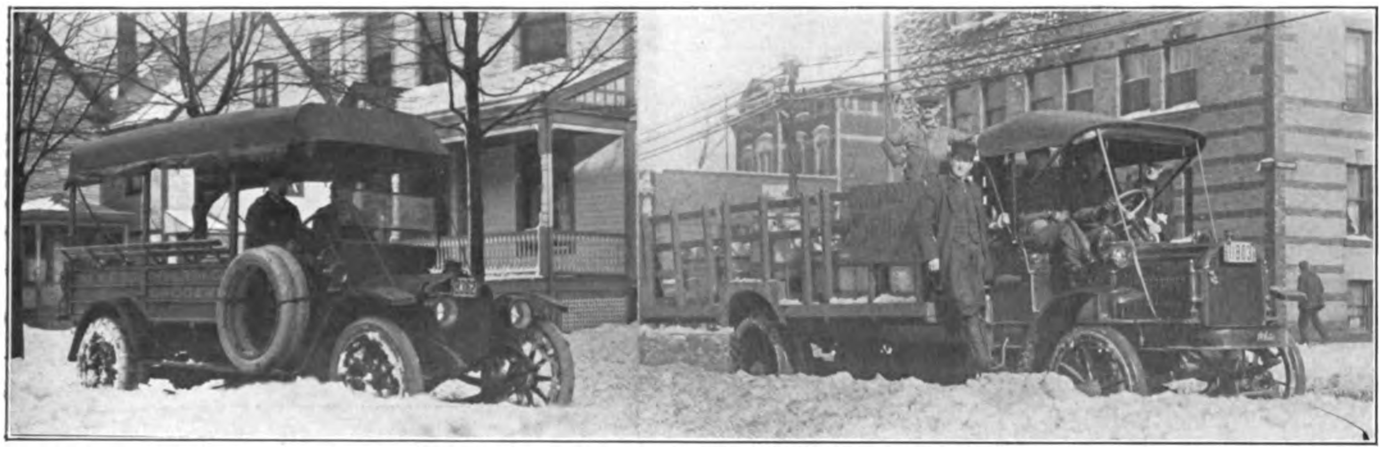
Food Distributed to Hungry Cleveland People When Other Transports Failed.

The blizzard that for three days swept the region of the Great Lakes, and extended from the Northwest to Buffalo, early in November, was most severe in Cleveland, O., where 22 inches of snow fell on a level, and this was drifted in many places to depths of five and six feet. The storm in itself was sufficient to cause great destruction, for the overhead constructions of the telephone, telegraph, lighting and trolley companies were broken down by weight of snow and the heavy wind, and the street and steam railroads were blockaded and cars and trains were stalled. Besides the snow, many streets were further obstructed by broken trees and poles and tangled wire and traffic through them with vehicles was not possible for several days, while during the storm it was at decided risk for pedestrians. In many instances the passengers were compelled to remain in stalled cars in the streets and where this could be done with safety cars were abandoned.

The storm and its hardships and destruction were serious enough, but the people, being cut off from communication with the usual sources of supply, with the railroads and streets blockaded, realized that the problem of obtaining food was one not to be lightly considered, and the actual needs of those who faced hunger called for work in the drifted snow that could only be done with motor trucks, and, in few instances, by powerful automobiles. Bucking snow that was more than axle deep when level, and sometimes higher than the machines when drifted, movement through the streets was only possible with motor vehicles when traction could be obtained.

By the end of the first day railroad traffic had practically ceased and streets were nearly impassable for animals. The second day, business was paralyzed and people were confined to their homes, and by the third day shortage of food caused a situation that was almost alarming. The shortage of milk, because of the blocked railroads and freight yards and the impossibility of distributing what was brought into the city, was indeed serious, and hundreds of people waded through waist deep snow to reach the depots of a large dairy company, where they waited in line for hours to get milk brought in by White five-ton trucks from milk trains stalled outside the city. The food stores were called upon for whatever was edible, and by the end of the third day the stocks were practically exhausted. The renewal of stock was dependent upon wholesalers making delivery.

At this time most of the vehicles that could be moved were laden with food. Motor trucks and wagons were kept moving under conditions that required the best that was in both machines and their crews, and many of the drivers proved to be real heroes, in that they endured great hardships, as the firms having machines kept them constantly at work. At best the mileage and load capacities of the motor vehicles were reduced, but work with them was always possible. Two of the largest wholesale grocers, operating 12 White trucks, made deliveries to many stores within a limited radius, but hundreds of retail establishments in the city and suburbs were without food stock until the streets were passable for other vehicles.



During the November Blizzard That Centred in Cleveland, O., the Food Supply Was Nearly Exhausted, and Great Hardship Was Averted by Distribution with Motor Trucks.

The American Glycerine Company, manufacturer of nitroglycerine, has installed in service at Findlay, O., a Commerce wagon that has been specially fitted for the transportation of this explosive, which is used by those operating in the oil fields for "shooting" wells and increasing the flow from them. Because of the danger from explosion extreme care must be taken in handling nitroglycerine, and special provision is always made for the protection of the workers. The Commerce wagon is fitted with a cradle that will practically absorb all shocks from the road and minimize their effect upon the load, which is, at maximum capacity, 840 pounds. In this machine the explosive is carried long distances and with a greater degree of safety than would be possible if it were transported by any other form of conveyance.

HIGH GRADE SELLING STATEMENTS.

THERE can be no subject of greater interest to the motor vehicle industry than promotion that will practically benefit it, and primarily this means that there must be argument made that will convince and establish confidence in motorized equipment, for unless there is conviction that motor wagons and trucks are practical nothing can be gained by discussion. Naturally consideration of the qualities that make for economy must be in the nature of selling talk, and whatever is stated should be broadly promotive and not of a character that will cause doubt in the minds of those who are studying or investigating the subject.

Much attention has recently been given by different business and trade organizations to policies that will impel attention from the soundness of the statements made, and which will, while establishing the merits of any given product, have the value of promoting the use of power wagons generally instead of causing distrust of all other vehicles than that directly discussed. Fundamentally there is need of methods and presentation of facts that are educational, which can be broadly applied and are yet sufficiently specific to be associated with the conditions generally obtaining with industrial or commercial enterprises.

There are those who believe in the utility of electric vehicles, and those who build these machines devote careful study to the presentation of statements that will be promotive of their use. Education of the people is essential, and where those who are interested cannot be conveniently reached by salesmen there is imperative need of such systematized representations as will convince. Misrepresentation would be destructive and conservatism is better than ill-advised enthusiasm.

An admirable example of high grade salesmanship is subjoined, it being a communication prepared by A. C. Downing of the Anderson Electric Car Company, Detroit, Mich., which is sent to inquirers who seek information relative to the Detroit electric vehicles. This is broad gauge and well founded, and it will be noted that this policy can be applied equally well to any make or type of machine with, assumedly, equally satisfactory results:

The Electric Vehicle and Its Service.

The world's business depends almost entirely upon the transportation of merchandise from producer to consumer. City and immediate suburban transportation is increasing with wonderful strides. The passenger automobile has made it possible for a family to live in a suburban district and yet transact business in, and depend upon, the city for supplies. Further, the improved street railway, interurban lines and subway roads have increased the area of our cities; therefore, a merchant, to keep pace with the times and for the purpose of giving his patrons service, must have a delivery equipment capable of covering a great number of miles per day. The improved streets and roads aid materially in the successful working out of the self-propelled commercial vehicle. Under these new conditions the horse drawn equipment is working at its lowest efficiency while the self-propelled vehicle is at its highest.

The first successful self-propelled commercial vehicle was the electric. With the increased knowledge of batteries, motor and general construction the electric commercial vehicles of recent years are unquestionably accepted as the most efficient, reliable and economical for general city and suburban service. The great number of recent installations have performed in such a manner as to fully confirm and credit the performances of electric commercial vehicles installed 10 or 12 years ago.

Changed Conditions.

The general reduction in the price of electricity for power purposes has greatly broadened the field for electric vehicles. The improved streets and roads above mentioned have also increased their possibilities. The demand for reduced speed in merchandise transportation has brought the electric back into its own. At first the opinion was that the electric vehicle was not of ample speed, but continuous service and numerous tests and trials, along with the municipal regulation of speed, have proven conclusively that high speed is not practical or necessary to make time where the stops are more or less frequent.

Drivers.

Drivers in the majority of cases should be men trained in the handling and delivery of a certain kind of merchandise. Using for example the furniture business, a customer might become completely dissatisfied if the goods purchased were not placed in her house so as to make a favorable first impression. With the electric car your regular trained driver can be instructed in a very few lessons as to the successful handling of the car, as its simplicity in operation and care does not necessitate an especially trained man.

Further, in a limited equipment it is possible for two or three men to know the operation of the car, so a delivery service is not crippled in the case of illness of the regular driver. The expense of having an extra man on the car to handle the goods is not necessary unless the business requires two men in order to increase the efficiency of the vehicle, by reducing its time idle.

For a large installation where the personal qualifications of each and every driver are more or less of an unknown quantity the electric machine has proven the most satisfactory, as its successful working out is not dependent upon the individuality of the driver. In other words, the operator of the electric vehicle does not materially affect it provided he will guide the car and use his brakes with judgment and think about the expedient delivery of his goods.

Garaging.

There are numerous installations of 20 to 25 cars which are kept in excellent condition by four men. This includes the washing, oiling and charging of the cars daily, making all minor repairs and adjustments, and complete care of the batteries. In some larger installations 50 or 60 cars are garaged by six or seven men. In one or two-car installations it is possible for the driver to wash, oil, charge and adjust his machine, and then for major work or annual overhaul, the services of a local garage may be called upon. Where five or six machines are owned by a firm it has been found expedient and economical to place them in the charge of one man who has ample time to keep all in A 1 condition ready for daily service. One concern in particular has had 10 machines in the hands of two men, with an excellent record for care, attention and service. These men have cared for the machines for three years without need of additional help, thus fully proving that the age of electric vehicles does not mean an increase in labor to keep them operative.

Insurance.

Insurance companies make no discrimination in the rates of warehouses or buildings in which electric machines are garaged. This feature has made it possible for many merchants to keep six to 10 machines in their warehouse and thus reduce to a minimum the expense of floor space, and at the same time have their affairs more centralized. In one, two or three-car installations this plan is especially valuable, as the night watchman can keep in touch with the cars should there be any special points to be watched.

Rents are naturally high in the larger cities. One electric vehicle requires very little more space than a horse drawn wagon of equal capacity, thus the space required for horse stalls, hay mows, harness and feed rooms is saved. In addition, an electric commercial vehicle is capable of doing the work of two (sometimes three) horse drawn rigs. At a glance the importance of this item is seen. As to space for repair shop and stock room, electrics require the minimum as their requirements in this direction are very slight.

Why Efficient for City Use.

The ability to make frequent stops and starts places the electric vehicle in a field by itself for service in congested districts. All tests to prove the above statement have clearly shown that no matter whether the electric vehicle is running up or down hill, or on the level, wherever stops and starts are more or less frequent the speed remains very close to constant and averages higher when compared with any other method of transportation, no matter what the speed possibilities may be. This feature is due to the rapid acceleration of the motor and simplicity in operation of the controller. One essential point of the electric vehicle is in the non-use of power while the vehicle remains idle for short periods.

Life and Operating Expense.

The life of the electric vehicle may be figured, with a certain degree of accuracy, at 10 years. This is not conjecture, but a fact, based on absolute records and daily working examples. With a limited amount of money spent at the proper time for mechanical upkeep there is no excuse for a properly designed electric vehicle ever becoming completely disabled, barring accidents, of course. Nor is there any reason for the upkeep cost ever becoming prohibitive. To prove these statements pick up the dealers' lists of second hand vehicles, ex-

amine the advertisements in the daily or trade papers, or try to buy a second hand electric commercial vehicle from any source and you will be convinced as to their remaining in service and efficient; otherwise many would be for sale.

Mechanical Make Up.

The electric motor of ample size and proper design has an indefinite life. A controller of proper proportions for a given motor should represent an equal life with a very limited expense for upkeep. The wiring if installed in conduits and properly anchored should never cause trouble unless it be badly injured. The frame of an electric vehicle chassis is made of all steel, which will never wear out, and the springs, if made of proper steel and bushed at the eyes, should last for years. The axles, front and rear, should not need renewal, as bearings take up the wear and they are easily replaced. The steering knuckles are fitted with bushings, which can be replaced, and the pins, if hardened and ground, should last two or three seasons when properly lubricated. The shackle bolts, steering tie-rods, brake shoes, brake linings, brake rods and springs for the vehicle throughout should represent a very limited yearly expenditure. The type of drive would govern to an extent the cost for power transmission parts, and this expense is governed largely by the care of the machine as to necessary adjustments and lubrication.

Battery.

The battery can be figured at a certain cost per mile, with or without current. Batteries having a guaranteed capacity and life are now sold. There is definite knowledge as to the amount of current necessary for a full charge, and, where operating conditions are known, the number of miles a car makes per charge can be divided into an average daily battery expense and the cost per charge, thus giving a fairly accurate daily or per mile upkeep and operating cost. Further, with the life and capacity of the battery guaranteed the buyer is insured against an excessive upkeep cost. This point is particularly valuable where a machine is to be installed and cared for in a private garage or where several vehicles are to be looked after by one man, when especially trained help is not feasible.

Tires.

The tires on the electric commercial vehicle are of the solid type. Their use is practical as the speed of the electric machine is within range of this construction; and also the total absence of delicate parts and bearings permits the use of solid tires. This practise adds reliability and stability, to say nothing of the lower cost of upkeep. With solid tire equipment the driver is not to be delayed in his work on account of blowouts, rim cuts or punctures. With the standard S. A. E. band, as universally adopted by truck and tire manufacturers, the renewal of solid tires can be quickly made.

Service.

The subject of reliability previously mentioned interests the owner or prospective owner of commercial vehicles. An employee of irregular habits is not tolerated in any business for a moment; neither can this irregularity be tolerated in the transportation department of any business, as so many things are dependent upon prompt service. Any number of electrics have records of 295 to 300 days' service per year out of a possible 312. Where bodies do not require particular painting less time is lost. Several instances of constant daily service cover 18 to 24 months without a miss. Such records are due entirely to the simplicity and accessibility of parts entering into the electric's make up.

For example, the motor can be taken out and replaced in two hours' time by two men. Should a controller finger or plate become worn or burnt, another can be replaced in not more than 30 minutes. The axles, countershaft, steering mechanism and brake parts are common to all self-propelled vehicles; hence, electrics are at no disadvantage in this respect. Batteries can be replaced as a unit in 30 minutes, or individual cells removed and repaired during the night with no lost time recorded.

A concern in a central western city has been operating 20 electrics for the past six years. As its business demands daily service it figures 10 per cent. additional vehicles enough to warrant the required service. One machine is held in readiness to relieve another in case of accident and another is always in the paint shop for annual overhaul. During the peak of the holiday trade these extras are pressed into service and thus materially help pay their way.

Summary.

This discourse may be rather lengthy, but the writer has tried to cover in general the "whys and wherefores" of the electric commercial vehicle. The points touched upon are usually outlined in catalogues and circular letters, but in a meagre manner. If you were in doubt as to what power to purchase and it were possible for the writer to talk personally with you, his arguments would be along the lines of the foregoing.

The first cost of electric commercial vehicles properly equipped is greater than other equipments, but they will pay interest on their investments, stand the depreciation (which is low), pay for all upkeep, insurance, taxes and driver's wages, and still show a material saving over other methods of transportation working under given conditions.

Electric vehicles are much like humans—for a long time they will silently stand overwork, inattention and abuse, but finally give in. On the other hand, if electric vehicles are properly loaded, handled with judgment, lubricated and kept in adjustment, their life will be one of long service at low cost.

FREIGHT TRANSFER BY TRUCKS.

New Haven Road Installs First of General Vehicle Fleet at Boston.

The New Haven railroad system, which centres in Boston, controls two terminal stations, the North, which is used by the Boston & Maine, Fitchburg and other lines extending north and west, and the South, which it shares jointly with the Boston & Albany road of the New York Central system. There is a freight yard, with the receiving and delivering houses for each terminal. There is no connection between the two, and freight and baggage billed or checked from points on either system to points on the other must be transferred across Boston, from the one freight yard or station to the other.

This condition resulted from the fact that originally there were a number of roads, each independent of the other, but uniting in two main passenger stations. Later two stations were erected, the one for the Boston & Maine and the other for the New Haven road. As the traffic and the volume of freight and baggage to be transferred has increased from year to year the New Haven railroad has found street and terminal congestion during the working hours of the day and the limited capacity of animal vehicles a serious handicap, the expense and the delay becoming problems that required careful consideration.

The company's transportation engineers studied the conditions and made recommendation that trucks of large capacity be used, these to be largely utilized in haulage from one terminal to the other, and the work to be so systematized that loads could be carried both ways. With this purpose in view the company has ordered a number of General Vehicle machines which will be delivered as rapidly as possible. The first of these has been delivered and is now in service. They are fitted with bodies that will permit capacity loading when the freight is bulky, and the loads can be protected from storm. The haul from the one freight yard to the other is approximately a mile, and the machines can be worked as many hours as desired each day by an exchange of batteries should the normal mileage be exceeded. The intention of the company is to use as many trucks as shall be necessary. So far as is known this is the first instance of a railroad company in America using trucks in transportation, and the result is being watched with a great deal of interest by Boston business men.

Hugh Warner, formerly with the Warner Gear Works, Muncie, Ind., has been engaged as designing engineer by the Detroit Standard Gear Works, Detroit, Mich.

A company is being promoted in Detroit, Mich., by Peter Steenstrup, formerly sales manager of the Hyatt Roller Bearing Company, to sell the Livingston pressed steel wheel.

PARCEL POST DELIVERY.

White and Wagenhals Machines Purchased by Government for Special Service.

The United States Postoffice Department is now using 40 machines for the collection and delivery of parcel post packages in some of the principal cities of the country, and the results from the use of these will very largely determine the plans of the department for handling this division. The parcel post service was inaugurated Jan. 1, 1913, and each day the volume has increased, so that the department has been forced to provide facilities for collection and distribution as these needs have been realized, instead of making provision based on experience and knowledge of probable requirements.

With the public demanding prompt and satisfactory handling of parcel post packages the department has authorized the use of motor vehicles by contractors carrying mail and in some instances has permitted postmasters to make supplemental or provisional contracts for collection and delivery. The purpose has been with such service to make careful observation and record for the guidance of the department in determining needs and efficiency, and in a considerable number of cities what may be termed experimental work is progressing.

Mail carrying contractors have the option of purchasing or using whatever machines they believe will serve their purposes, and no restrictions are made, but when the government purchases its own equipment it specifies every detail, and the vehicles must conform to these. Thus far the Postoffice Department has made but two purchases of machines, making one contract for the delivery of 20 White 1500-pound delivery wagons with bodies that are completely enclosed, affording protection of the mails from storm and insuring against theft. These wagons have been delivered and they have been assigned to different cities where conditions have required increased facilities. These machines are located in some of the principal cities and are now giving excellent satisfaction.

The government has also purchased 20 machines from the Wagenhals Motor Car Company of Detroit, Mich., these being equipped with special bodies regarded as being adapted for collecting and delivering parcel post packages. These vehicles were ordered after careful investigation of the work accomplished in service in Detroit and other cities, and records showed that they were in every way reliable and dependable.

The Wagenhals machines are of the type generally known as tricars, such as are extensively used abroad, and have been developed with a view to hard and exacting service. A considerable number of patents cover the construction of the vehicles and these are maintained to be of special value with reference to economy and endurance. These wagons are made in one size only and have capacity of 800 pounds. They have motors of 20 horsepower and the claim is made that they can be operated with a large measure of economy. The body equipment is varied to meet the requirements of the purchaser.

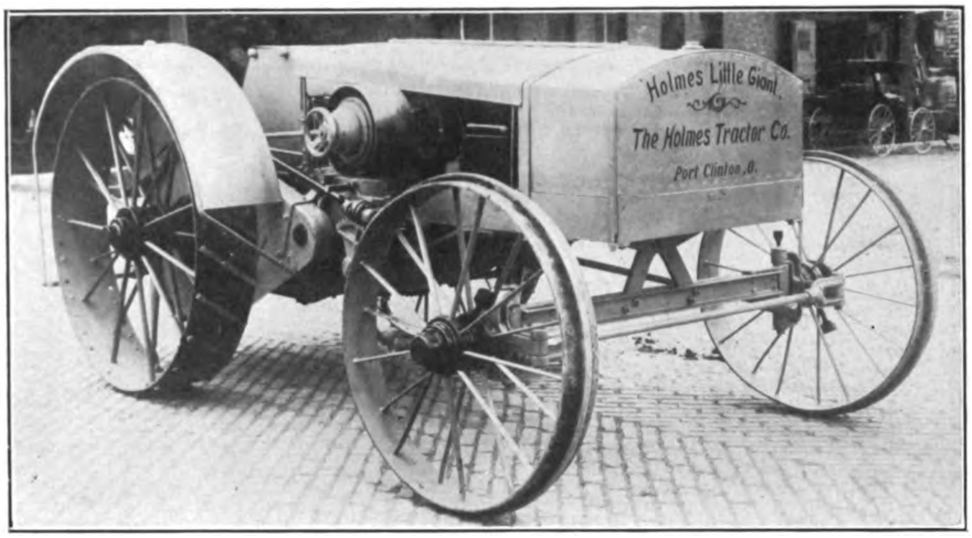
The two types of machines, which are illustrated, have been regarded as meeting the requirements of the parcel post division, the smaller vehicle being suited for routes where the weights are small, such as for rural delivery, and the other for work within communities of proportions. As now used they are attached to the service in different cities and are operated for many hours daily, for deliveries are made during one portion of the day and collections another, extending the day's period of usage to from 15 to 20 hours. The volume of business of the parcel post division is steadily increasing and the reserve capacity and endurance of the machines is absolutely necessary to insure economy in serving the people. With any other form of equipment these qualities can only be obtained by maintaining extra equipment or hiring it when needed.

The United States Postoffice Department Has Purchased 40 Machines, 20 Each of the Types Shown, for the Collection and Delivery of Parcel Post.

The Weston-Mott Company, Flint, Mich., has just occupied a new building, 320 feet long and 75 feet width, one story and monitor roof, which is absolutely fireproof, the material used in the entire construction being metal or concrete.

HOLMES LITTLE GIANT FARM TRACTOR.

THE Holmes Tractor Company, Port Clinton, O., is building a tractor, designed especially for farm purposes, that has many qualities to recommend it to those who have need for a machine that will do the work for which horses are used, and which can be utilized as a power plant for husking, shredding, pumping, grinding, sawing wood, and in fact, for any service for which a stationary engine may be required. The machine is not built for passengers, but it is constructed for work on cleared land that can be cultivated, and it can be driven in fields for plowing, harrowing, seeding, harvesting, and on roads it will haul trailers. The capacity of the tractor is maintained to be equal to that of two two-horse teams for field work, and on the road it will do more than two teams when trailers are used. The builders claim that it will do all the work necessary on small farms and all the light work on large farms, and that it is especially adapted for service in orchards.



The Holmes Little Giant Tractor, Designed for Agricultural Service and Used as a Portable Power Plant.

The tractor has been perfected by two years of experimental work and it has been constructed with a view of long endurance in all conditions of practical operation. The design is exceedingly simple and all parts are made with a large margin of safety. The mechanism is very accessible so as to minimize care and attention, and the parts are interchangeable and can be replaced readily whenever this is necessary by anyone who is not experienced in mechanical work. The tractor has a low centre of gravity, small turning radius and it can be used on ground that is comparatively rough.

Tractor Weighs 4400 Pounds.

The tractor is 138 inches length over all and is 72 inches width, and is 54 inches height. The weight is 4400 pounds. The chassis frame is constructed of steel channels, with sturdy cross members, the assembly being hot riveted. This frame is mounted at the forward end on an I section axle which carries a triangular bracket, at the apex of which is a trunnion on which the axle may swing, so that with one front wheel elevated or depressed there is no strain on the chassis. The rear end of the frame is mounted on springs and the drive from rear axle is through radius rods.

The water tank is carried at the extreme front end of the chassis frame and back of this is the motor, which is a conventional four-cycle, water-cooled, two-cylinder opposed type, with cylinder bore of 5.5 inches and stroke of five inches. This is rated at 12 horsepower by the maker, but it is rated at 14.2 horsepower by the S. A. E. formula. The engine is a standard construction and has a normal speed of 750 revolutions a minute. The crankshaft is heavy and is mounted in two long bearings, and by removing the crankcase cover plate the connecting rod bearings may be exposed. The timing gear is carried in a cage that is bolted to the engine case under the cover plate.

Adequate Lubrication Assured.

The engine is lubricated by a mechanical oiler that supplies oil to the main bearings and connecting rods, and the camshaft, valve tappets, timing gears, and the cylinder and piston walls are oiled by splash. The feed is positive and the connecting rods are insured adequate lubrication by a special device. The ignition is jump spark by current from either dry cells or a storage battery intensified by a coil. The normal fuel capacity is 25 gallons of gasoline, which is sufficient to drive the tractor for several days, as the working speed is estimated to be about 1.75 miles an hour.

The motor is mounted longitudinally in the frame with the crankshaft extending transversely, and on this, outside the flywheel, is the driving sprocket and the power transmission gearset. The gearset is a planetary type, affording two forward speeds and reverse, and the speed ratios are obtained by the usual hand lever. The drive to the jackshaft is by a chain from the engine shaft, the chain extending to a differential gear mounted on a sleeve. The main jackshaft extends through the sleeve and the drive is from one side through the sleeve and from the other through the shaft by sprockets and chains to sprockets on the rear wheels. The differential case is oil and dust tight and the gears have wide faces and are cut from grade steel. The jackshaft is carried on long roller bearings mounted in hangers that are adjustable, there being provision for ample lubrication. The driving chains are protected by chain cases.

The front wheels are 36 inches diameter and have

steel rims five inches width, in the centre of which is a ring that extends around the circumference, this preventing side slip. The rear wheels are 40 inches diameter and have steel rims 10 inches width fitted with diagonal cleats across the faces, these affording traction on any yielding surface. The wheels have steel hubs and steel spokes and are built with the spokes set in two series, separated practically the width of the hub and closer together when fitted in the rims. The front wheels are mounted on spindles that are pivoted in the yokes, following conventional automobile construction, and the steering gear is the usual linkage, controlled by a worm and sector and a steering column and hand wheel extending to the rear of the chassis.

Convenient Control Levers.

At the rear of the tractor, suspended from the chassis frame, is a platform, on which, directly behind the steering wheel, is mounted a seat such as is usually fitted to regular farming machinery, and convenient to this are the speed changing and the spark and throttle levers. The engine is usually controlled by throttle, but a hand adjustment can be used should there be need of less or greater speed than the normal control will afford. On an extension of the engine shaft at the right side is mounted a 12-inch pulley with six-inch face, from which a belt can be driven when the tractor is to be used as a power plant, and as the tractor can be blocked it will supply power up to its capacity and for any length of time required. The water tank will contain 40 gallons and the cooling system will prevent overheating no matter what the period or the conditions of service. The chassis is covered with a removable metal hood and the machine is fully protected.

The tractor is not unsightly as compared with farming machinery, but service and endurance, and not appearance, is the principal purpose, for polished metal and fine finish is lacking. The machine has been worked on grades up to eight per cent., and on the greatest gradient it has been more than equal to four horses for hauling. The road speed is about four miles an hour.

Showing the Holmes Little Giant Tractor Used as a Power Plant for Farm Work.

Plowing with a Little Giant Tractor, the Machine Replacing a Horse Team.

WILL BUILD HEXTER TRUCK.

The Roland Gas-Electric Vehicle Corporation, with capital of $200,000, the stock being half preferred and half common, has been organized by P. K. Hexter, Ronald R. Conklin and Sidney L. Conklin of New York City, and a factory has been secured at Avenue B and 20th street, where it is purposed to build gas-electric trucks of three and four tons capacity. The factory will be managed by Mr. Hexter, designer of the machine, and plans made comprehend the production of 100 machines the first year.

The chassis will have a 136-inch wheelbase, standard tread, and will be carried on 36-inch front wheels and 40-inch rear wheels. The power plant will be a gasoline motor of the four-cycle, water-cooled, T head type, with cylinder bore of 4.5 inches and stroke of 6.75 inches, lubricated by combination force feed and splash, and having magneto ignition with automatic spark advance. This motor is carried in a sub-frame. The fuel supply is governed by a foot accelerator. An electric generator is mounted in the sub-frame and this is connected with the flywheel end of the motor shaft by a flexible coupling. The generator is a 7.5 kilowatt, compound-wound machine. The generator is turned at engine speed, producing at 900 revolutions 60 amperes at 125 volts. From the generator the current is supplied to two motors mounted on the rear axle, each driving one wheel. Through the variance of the engine the speed of the truck may be controlled between an eighth mile and 15 miles an hour.

The Republic Rubber Company, Youngstown, O., following out the policy of direct selling it has established, has acquired control of the Republic Rubber Company of New York and will continue the business of that concern at 229 West 58th street, New York City. F. G. Hill, who was secretary and sales manager of the former company, continues in charge of the tire sales, and C. W. Hardin, who was eastern manager for the Republic Rubber Company, has taken charge of the mechanical sales as vice president and treasurer.

DEPARTMENT STORE DELIVERY ECONOMY.

THE experience of the Sterling & Welch Company, Cleveland, O., one of the largest concerns of that city dealing in furniture, carpets and household furnishings, with motor delivery equipment, which was begun in May, 1910, has very conclusively demonstrated that with good organization and careful supervision, not only can extreme satisfaction be obtained, but the business done can be extended and customers served in an area that could not be covered with any other form of transportation. The company now has 10 motor wagons in use, the number being increased as efficiency became assured, and the economy attained has been in every way gratifying.

Of ten machines in service seven are White wagons, three of 1500 pounds and four of 3000 pounds capacity. The first purchased were two White vehicles of the larger type. In May, 1911, two more were bought, and in April, 1912, the three smaller wagons were acquired. These chassis were fitted with bodies adapted for carrying furniture, these having standing tops and side curtains to protect the loads. All of the equipment is shod with pneumatic tires.

Four of the Fleet of Seven White Delivery Wagons in the Service of the Sterling & Welch Company's Department Store, in the City of Cleveland, O.

The company took up the delivery problem with care and with methods that promised to yield economy and efficiency. First of all it selected horse drivers and trained them in the operation of the wagons. It established a garage and fitted it with such equipment as was necessary to maintain or repair the machines, and employed a man whose duty it was to see that they were always in condition for service. Provision was made for expansion as the number of vehicles was increased, and system was adopted that would insure accurate knowledge of the work done and the expense of operation and upkeep.

While the company's garage is not distant from the White factory, none of the wagons has ever been sent to the maker for work, the garage force being capable of doing whatever has been found necessary, and the character of supervision and careful driving has minimized the labor and attention required to keep them in fine condition. For instance, in November, 1912, after three of the wagons had been driven approximately 40,000 miles each and they had been in service about 2.5 years, they were overhauled and completely restored at a cost of about $100 each. The depreciation is estimated at 20 per cent. a year, but the results with these were such as to indicate that a much longer period of service could be obtained with them.

One of the wagons first bought was recently overhauled, after being driven 65,000 miles, in 3.5 years, and the cost of parts used in restoration was $35, despite the fact that the machine had been driven for what was believed to be 70 per cent. of its life. The pneumatic tires used have been driven an average of about 4000 miles.

The company makes delivery in Willoughby, 19 miles east; in Dover, 14 miles west, and in Brocksville, 15 miles south, and to all localities between, so that these distances do not give an accurate idea of the mileage driven. Each wagon is assigned to a route and it is required to serve this, making direct deliveries from the store or warehouse to the customer. The machines make two trips daily and because of the character of the goods carried a half hour is allowed for loading, this taking an hour from the day's service time. The drivers report at the store at 7 in the morning and return about 5:30 from the second trip, averaging about 8.5 hours in covering the routes, but all of this time is not required for driving, a considerable part being given over to unloading, setting up furniture and the like, which is required by the customers.

The wagons are driven an average of 62 miles daily and make 65 stops, so it will be seen that a greater portion of the time is taken up by intervals of idleness than might be believed, for did the stops average but three minutes each this would account for more than three hours. The company's officials believe that from 40 to 45 horses would be necessary to do the work that is now done with the trucks. But the greater radius of delivery is extremely important, for it has materially increased the patronage and it is evident that to go further than 10 miles from the store with animals would not be economical. The delivery depart-

ment is in charge of an expert of long experience, who is progressive and does not hesitate to make changes when the service will be improved. The fact the company has trained its own men, who have long experience in handling its goods and realize their own responsibilities, is a very important factor. The men are well paid and work for the interests of the company, both while driving and in handling and delivering the freights they carry.

CANFIELD PATENT IS VALID.

A. R. Mosler & Co. Obtains Injunction Prohibiting Sale of Infringements.

A decision by the United States district court of appeals in New York City, made by Judge Lacombe and concurred in by Judge Ward and Judge Rogers, in the suit of A. R. Mosler & Co., against John Lurie, maintains that the Canfield patent, owned by the complainant, is valid and the defendant is enjoined from selling the six different makes of spark plugs named in the bill of complaint. The attorney for the complainant, W. A. Redding, claims that the decision is very broad and that it will affect practically every maker of spark plugs.

The Canfield patent is the invention of Frank W. Canfield, engaged in lumber trade at Manistee, Mich., the papers establishing it being issued Oct. 18, 1898. He died the following year. The patent was acquired by the Associated Patents Company, which organization was affiliated with the Association of Licensed Automobile Manufacturers. The association licensed each member to use the plug and then sold the patent to A. R. Mosler & Co.

Lurie was proprietor of the Automobile Supply Company, New York City. The suit for infringement was begun in 1909 and it was dismissed in the United States circuit court by Judge Mayer. An appeal was taken and this has now been decided. The principal claim is for a recess in a spark plug surrounding the central electrode to prevent the accumulation of soot or carbon, this recess being necessary to insure a full spark and prevent a short circuit.

The Muncie Gear Works, Muncie, Ind., which had been conducted by a receiver for a short time, has been reorganized, the capital increased from $300,000 to $500,000, and these officers elected: President and general manager, Thomas W. Warner, Toledo, O.; vice president, Dr. W. A. Spurgeon; secretary-treasurer, J. Roy Goethus. Hugh L. Warner and D. O. Skillen have retired as vice president and secretary-treasurer, but continue their interests in the company. Creditors have accepted preferred stock to the amount of $230,000 in settlement of their claims, and cash settlements to about $35,000 have been made with others. The company has resumed operations at its old plant.

REACHING THE INQUIRER.

Electric Vehicle Association's Handbooks for Investigators of Haulage Data.

The Electric Vehicle Association of America, which has for the past two years conducted a campaign for the general promotion of the electric vehicle for pleasure and service purposes, has published two booklets which are available for distribution by the secretary to all inquirers, or which may be circulated by the members of the organization to those who might be interested in the subject.

These booklets are entitled "The Story of the Electric Pleasure Car" and "The Story of the Electric Commercial Vehicle", the former being 24 pages and the latter 36. They are cleverly designed, carefully illustrated and the typographical work is decidedly effective. The booklets are similar in character and general makeup, but deal with different subjects. That devoted to the commercial vehicle introduces the importance of haulage problems and then considers briefly electric machines and their reliability and efficiency as demonstrated by experience covering a period of about 15 years, and by instances of continuous service for 10 years or more for firms of national repute. Attention is given to the development of electric service wagons and trucks from the viewpoint of engineering, and the remarkable progress made in battery construction, establishing the claims for efficiency and endurance at low operating expense, and emphasis is made of the very rapid adoption of these machines. Last, but not least, the constantly lessening cost of electric current is shown.

Under the caption "The Electrical Commercial Vehicle of Today" the economy of electric vehicles is briefly explained and examples are given of the experience of concerns that are realizing the fullest measure of return from scientific transportation methods and the best equipment obtainable. Then follows estimates of cost and salient facts relative to service and reliability. Comparisons of operating expense estimates for electric machines and animals in varying service are of decided interest. The booklet contains illustrations and brief specifications of some of the machines built by those who are subscribers to the general publicity fund of the association. The booklets are free to all who are interested sufficiently to make inquiry of the secretary of the Electric Vehicle Association, 124 West 42nd street, New York City.

The Front Drive Motor Company, which was organized by Walter Christie to build tractors to use with differing forms of equipment, and which has been located at Hoboken, N. J., for nearly two years, may remove to Erie, Penn. Most of the tractors built have been utilized for fire department work, principally for hauling engines and ladder trucks. A considerable number of these tractors are in service in New York City.

CARTER PISTON VALVE MOTORS.

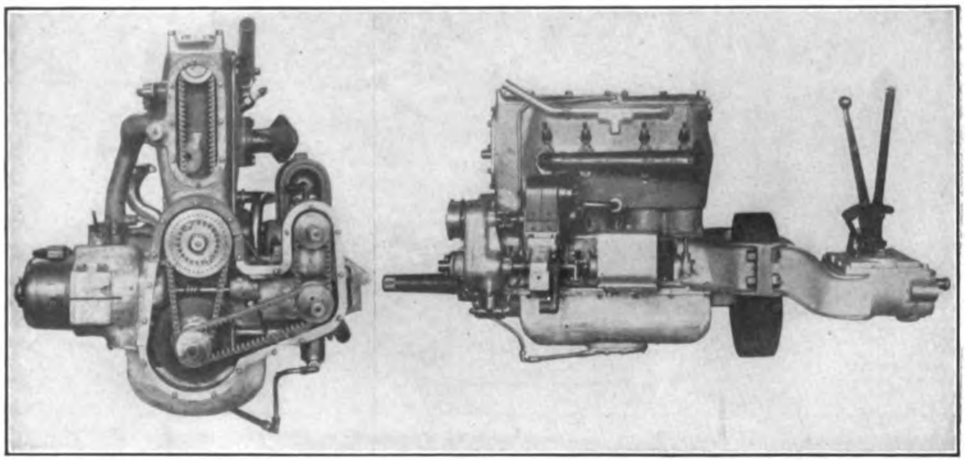
THE Carter piston valve motor is now being built by the Model Gas Engine Works, Peru, Ind., in a single size, but it is the purpose of the company to produce this engine is several sizes in a factory that is now being developed at Pittsburg, Penn. The motor is designed for use in all types of motor vehicles and the claim is made by the maker that the efficiency is considerably higher than is obtained with engines of conventional types of the same proportions. In other words, the power plant is lighter at the same power than the usual forms of poppet valve engines.

The motor differs from others very generally in appearance, but as will be seen by the line drawing the only variation from established principles is in the use of the valve mechanism. The illustrations are of a size now being built at Peru, and this is a four-cycle, water-cooled engine with cylinder bore of 3.75 inches and stroke of 5.75 inches, this giving a bore to stroke ratio of 1:1.652. This has a rating by S. A. E. standard of 22.5 horsepower, but the engine will develop 30 horsepower or better at maximum capacity, for increased efficiency is claimed as a result of the use of the valves.

The valve mechanism is decidedly at variance with recognized construction standards. The cylinder is bored straight through, as may be seen in the drawing, and into cylinder head the second piston is fitted. The piston carries three compression rings, practically the same as the power piston, and on the extension at the base of this piston two expanding rings are fitted. These are designated in the drawing as A A. These rings close the intake port C and the exhaust port D and serve the same purpose as the ordinary poppet valve. The upper piston is actuated by a camshaft, and the cams E E and F, practically the same as poppet valves are operated. The camshaft is placed across the top of the cylinders, both the cylinders and pistons being slotted to receive it.

The upper piston is fitted with a standard wristpin, shown as G, and a roller H, which contacts with the centre cam F. The bridge I across the top of the piston contacts with the two outside cams represented as E E. The outside cams E E are in duplicate and are ground so that they are in contact with the bridge at all times, and the centre cam F is also in contact with the roller H at all times. The cams are so ground that each movement of the upper piston corresponds to that of the ordinary poppet valve of the standard motor. This insures positive movement of the piston valve in either direction.

Considering the operation of the motor, on the suction stroke the vacuum is created that will cause the upper piston to follow the power piston to a position where the cam serves as a stop, or practically "times" its movement. As the power piston is forced upward on the compression stroke the compression serves to lift the upper piston, the cams again serving as a stop and definitely placing it. Near the end of the explosion stroke the pressure on the upper piston is sufficient to not only raise it for the opening of the exhaust port without the service of the cams, but actually exercises sufficient energy to materially relieve the camshaft driving mechanism. With a six-cylinder motor the energy is enough to drive the camshaft so that the driving mechanism merely controls. It is noticeable that at no time do the valve ports open against pressure, so that whatever wear there is is on the cams, and is on the heel, or on that part that is receding from the corresponding wearing surface.



The Carter Piston Valve Motor: At Left, the Timing Gear Case, Showing the Silent Chain Drive of the Camshaft, Water Pump, Magneto and the Worm and Gear Driven Motor Generator; at Right, the Unit Power Plant, Exhaust Side.

The effect of the operation is stated by the maker by comparison with a poppet valve motor with cylinder bore of 3.75 inches with a 1.75-inch valve lifting .375 inch, the piston valve motor having the same cylinder bore and a port .15625 inch extending completely around the cylinder with the exception of .75-inch allowance for the lap of the ring. The total area of the poppet valve is 2.06 inches and of the piston valve 1.75 inches. The time required for the full opening of the poppet valve from start, in crankshaft revolution, is 102 degrees; time required for the full opening of the piston valve from start, in crankshaft revolution, 62 degrees. The "time" required for different degrees of opening of both types of valve is stated as follows:

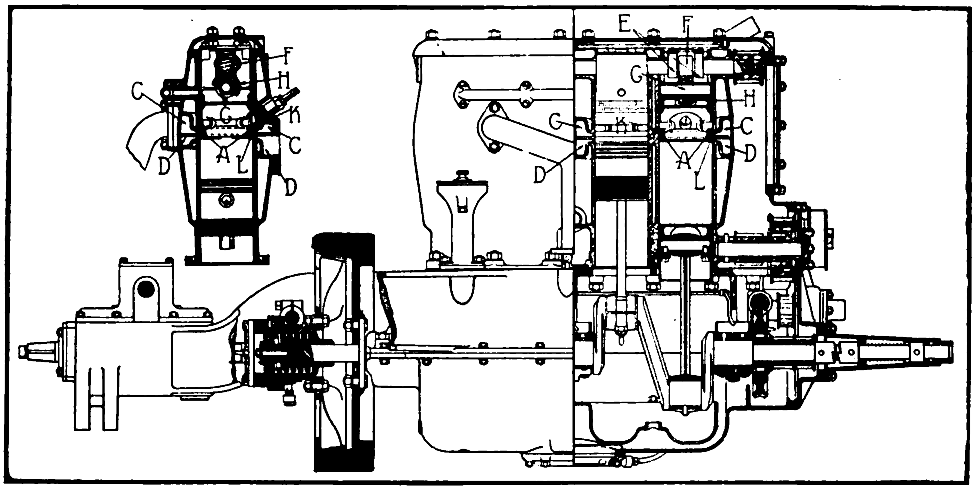
Opening	Poppet Valve	Piston Valve
Full	102 degrees	62 degrees
Half	58 degrees	21 degrees
Quarter	40 degrees	15 degrees

Degree "Time"	Poppet Valve Equal	Poppet Valve Area	Piston Valve Area
23	.03125 in.	.17 in.	1.10 in.
34	.06250 in.	.34 in.	1.43 in.

40	.09375 in.	.51 in.	1.53 in.
58	.18750 in.	1.03 in.	1.70 in.

This comparison is intended to show that with the last figures the poppet valve has but half the valve area open at 58 degrees movement, while the piston valve gives within .05 inch of the full area. Or, it is put in this manner: That the number of degrees of movement required of the crankshaft to open the poppet valve .03125 inch will, with the piston valve, give approximately 6.5 times the opening.

In the drawing the motor is shown with the exhaust port open and the piston on the exhaust stroke. Beginning the suction stroke, the cam F moves the upper piston down until the intake port C is open, which simultaneously closes the exhaust port D. The point K on the valve is indicated by the point L on the cylinder wall. Near the end of the suction stroke and the beginning of the compression stroke the upper piston moves upward .25 inch, or only half the entire stroke, so that the rings A A are in the positions



Transverse and Sectional Views of the Carter Piston Valve Motor, Showing the Pistons, Valves, Overhead Camshaft and General Details of Construction.

shown by the dotted lines, closing both exhaust and intake ports, the piston remaining without change during the compression and explosion strokes.

Near the conclusion of the explosion stroke the upper piston again moves .25 inch upward, until the exhaust port is fully open, as is shown in the drawing. It is pointed out that the movement of the upper piston at no time exceeds .25 inch, while the total movement in either direction is .5 inch, the full movement taking place during the two revolutions of the motor. With a motor having stroke of six inches the movement of the working piston is 24 times that of the upper piston.

Claim is made that the motor is practically noiseless, that there is less vibration, that the valve opening is quicker, that it has greater economy, more power for piston displacement, greater piston speed, less heat is lost through the cooling by water, that carbon does not affect the valve, that adjusting or grinding valve is unnecessary, no working parts are exposed and engine is more easily handled by those not experienced, that the engine will endure more abuse and needs less repairs. The maker states that the economy is fully 20 per cent., that the power is from 20 to 25 per cent. more, and that the piston speed will be increased from 20 to 30 per cent.

As will be seen from the accompanying illustration the overhead camshaft is driven by silent chain that is steadied by an idler sprocket, the camshaft carrying a slightly smaller sprocket, the chain moving close to the cylinder wall. Two other silent chains are used, the one for driving the water pump and the other driving the magneto. All the chains are enclosed.

The engine is fitted with a starter that is mounted at the right side, the armature shaft being coupled with a transverse shaft that carries a worm that meshes with a gear mounted on the crankshaft. The starter is clamped to the engine case. All parts of the assembly are well protected and are very accessible.

The engine, while it has appearance that associates it with conventional designs, is protected by no less than 14 patents that have been granted within a year, and other applications are now pending. The maker, however, has so far perfected it that description of the detail has been made public and invitation is extended to engineers and others who may be interested to visit the factory and witness any tests that may be desired, or those that will have bearing on the claims for efficiency and economy. The purpose is to build these engines at the Pittsburg, Penn., factory, and this will be equipped with the special machinery and facilities necessary for production. The design has attracted much attention from engineers and the work that can be accomplished with the Carter motor will undoubtedly be closely observed by the engineering fraternity.

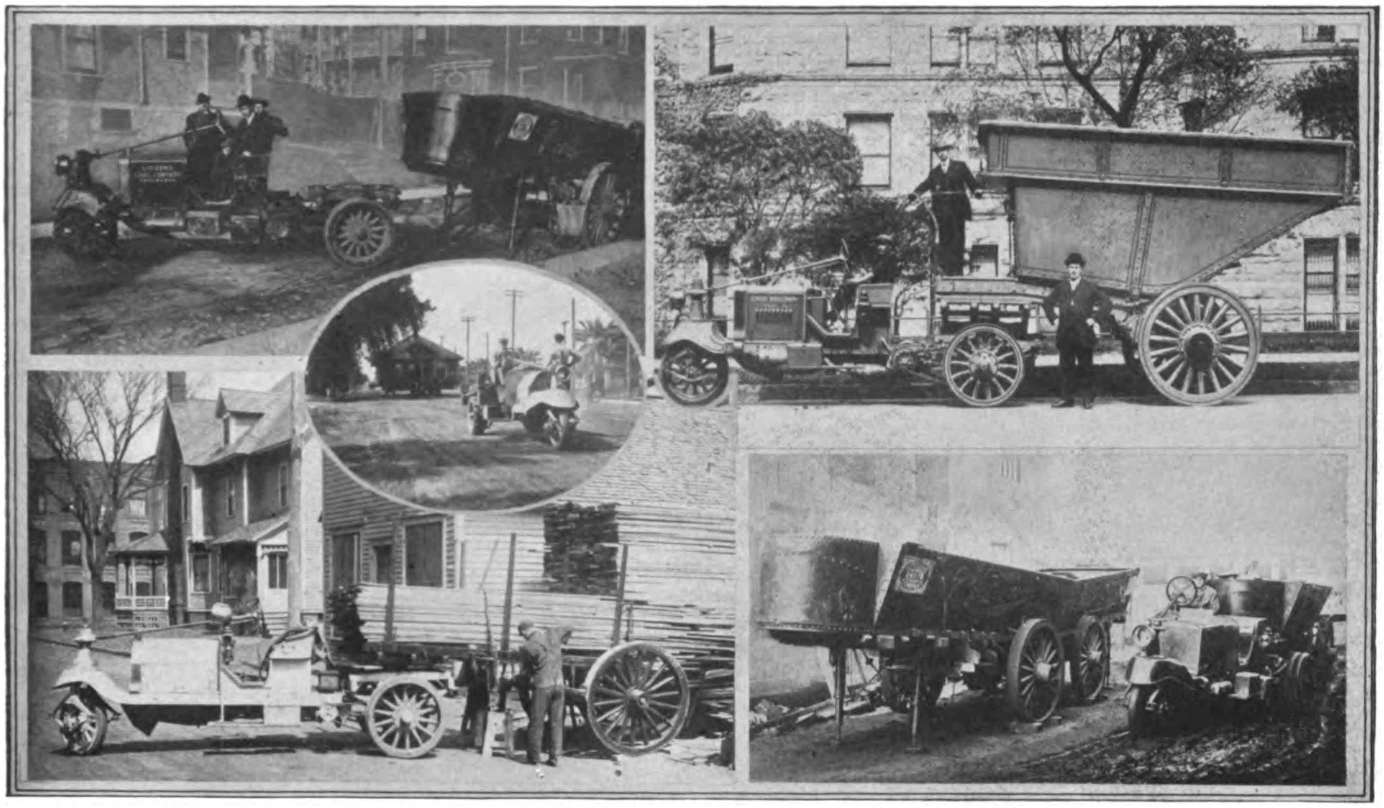
The Parcel Post Equipment Company has been organized to succeed the Grand Rapids Motor Truck Company, Grand Rapids, Mich., and has taken over the property of the latter concern, which failed. The new company is headed by Frank T. Hulswitt, E. Alfred Clements, Carroll F. Sweet, William F. McKnight and L. W. Coppock of Grand Rapids and John I. Taylor of Boston. The company will produce a 3000-pound delivery wagon similar in design to the Decatur, which was originally built, and will specialize a smaller machine which is expected to meet with the general requirements for parcel post delivery.

The new plant of the Four-Wheel Drive Auto Company, Clintonville, Wis., will be ready for occupancy about the middle of December, and with the equipment now being installed the production of the company will be materially increased.

ADAPTABILITY OF KNOX-MARTIN TRACTOR.

ONE of the strong points claimed for the Knox-Martin tractor, made by the Knox Automobile Company, Springfield, Mass., is its versatility. Coupled with this is its flexibility. In fact, it is maintained by its inventor, Charles H. Martin, that it is capable of supplanting the horse in every respect. Perhaps it were better to state that it is capable of supplanting a number of horses, for, of course, this is true when its pulling ability and speed are taken into consideration. Accompanying illustrations show some of the uses to which the Knox-Martin tractor has been put, and indicate its versatility and flexibility.

Very possibly, the desirability of securing a tractor of this nature was first demonstrated by the lumber trade. The earlier installations of motor vehicles with lumbermen established the fact that they could be used to advantage in competition with horses, but their economy and efficiency were found to be somewhat dependent upon the possibility of keeping them steadily employed. As a result of this situation, lumbermen began experimentation with a view to securing some method of eliminating delay in loading and unloading.



Illustrating the Versatility of Knox-Martin Tractor: Upper Left and Lower Right, in Coal Delivery; Upper Right, Hauling Ashes; Lower Left, in Lumber Work; Insert, Moving Houses.

Mr. Martin feels that he has entirely solved that problem. The use of his tractor permits one wagon to be loaded while another is on delivery. The front portion of the wagon, or trailer, is jacked up during the loading process, and when the tractor returns to the yard, it is released from its trailer, which is jacked up in a similar manner, and backed under the forward end of the loaded wagon. The time consumed in the operation is a negligible quantity.

The same method applies in the coal business, as may be noted from two of the accompanying illustrations. Here, however, another factor sometimes enters into the consideration. It often becomes necessary to back a load of coal into an alleyway or other position, so that it may be dumped into a side pocket. Another photograph reproduced herewith indicates the flexibility of the tractor in this respect.

The tractor virtually has two steering pivots, one consisting of the front wheel and the other, the king pin on the body, making it possible to turn the entire vehicle around in a very small radius and therefore avoid a large amount of manoeuvring necessary with horses. This is a feature the value of which will be understood in crowded traffic or in difficult places such as that presented.

The power of the Knox-Martin tractor can be appreciated when considering the view of what is regarded as one of the largest motor truck installations in the world. This vehicle is in use by a New York City contractor and is utilized for hauling ashes. Its capacity is rated at 15 tons, and yet vehicle and load are handled as readily and as easily as any of the smaller installations depicted.

If further evidence of the machine's versatility is needed, attention may be drawn to the insert in the group cut. This view was taken in Los Angeles, Cal., and illustrates one of the two jobs of like character ac-

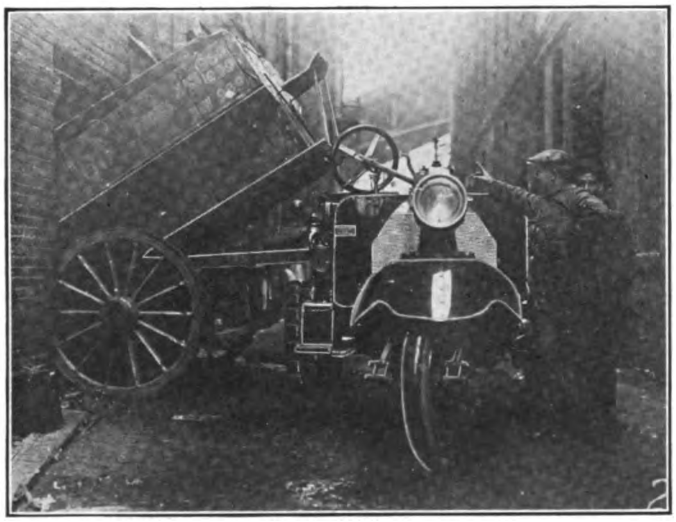
complished by the same Knox-Martin tractor between midnight and sunset of the same day. The two houses each weighed about 25 tons and were moved a distance approximating two miles.

Practically every reader is familiar with the old fashioned method of using a horse and winch for such work. Those who have watched the progress of a house through the public streets of a city under this arrangement are able to appreciate the comparative speed possibilities of the Knox-Martin tractor in this work, when it is remembered that the two houses were each moved about two miles in approximately 18 hours on the day in question.

UNIFORM MOTOR VEHICLE LAW.

Automobile Chamber of Commerce Favors Legislation Alike in All States.

The Automobile Chamber of Commerce is now on record as favorable to the enactment of legislation sim-



Indicating How the Knox-Martin Tractor May Be Backed into Difficult Places.

ilar to that in effect in Massachusetts and to the regulations recently promulgated in New York by the state highway commissioner; that is, that limit speed of machines weighing six tons or more to 12 miles an hour and of four tons or less than six to 15 miles an hour, the weight including the load. The directors of the chamber are opposed to overload and driving in excess of the speeds stated. The attitude of the directors is based on the belief that public opinion will be reasonable if there is understanding of the facts. To illustrate, the motor vehicle industry is quite as much interested in the preservation of roads as are the taxpayers themselves, or the owners of machines, and they are conducting a constant campaign for the development of highways, but they maintain that the passage of laws designed to protect the inadequate roads and bridges at the expense of the natural development of economical haulage by power vehicles, will only react to retard the really necessary improvement of the highways.

The directors in a statement emphasize that facts bear out the claim that animal traffic and passenger cars driven at high speed wear highways far more than trucks and wagons driven at slower speeds, and point to reports of state highway commissioners and to tests made by the United States government which show that motor vehicles driven up to 15 miles an hour were no more wearing than are animal vehicles. The directors object to all proposals to increase registration fees and maintain that excessive fees and unreasonable taxation is against public policy. It is maintained that the states would profit more by encouraging the use of motor trucks by continuing by a flat rate of $5 for all service machines.

In a statement the directors quote liberally from reports of different state commissioners and officials to strengthen their position, and hold that highways can be built and maintained so as to obtain satisfactory results at reasonable expense of construction and maintenance.

SEAMLESS STEEL TANKS.

Janney, Steinmetz & Co., Philadelphia, Penn., maker of pressed steel tanks, has begun, after a year of experimental work, the production of a seamless steel tank of rectangular section that is especially adapted to motor wagon and truck equipment. While suited for underslung installation of pleasure cars the tank has unusual qualities for wagon and truck use in that the former greatly economizes space and can be located where it will not take up space that might be desirable for loading purposes. The seamless tank insures against leakage of fuel and the accompanying danger and the production of the square form is regarded as a distinct advance in the art of metal drawing. These can be made in varying sizes, but are produced 13 inches square and from 30 to 36 inches length, and 12 by 14 inches and in different lengths between the two dimensions stated. These are furnished with or without Janney, Steinmetz fittings, which include brass gooseneck extension fillers, outlets with sediment cups, up-feed tubes for pressure installations and indicators to show the contents.

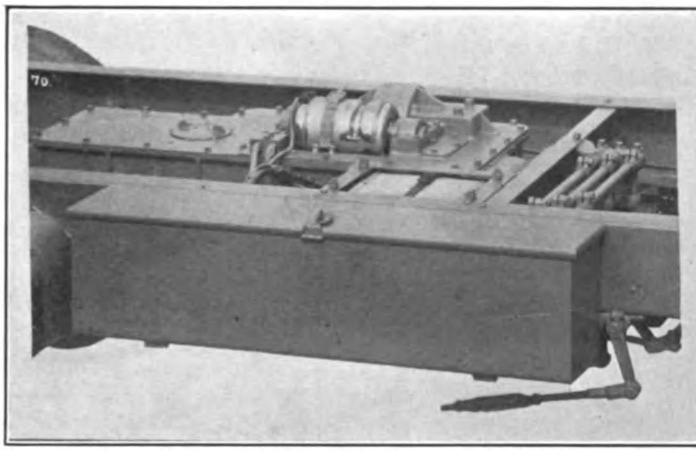
A four-ton KisselKar truck is used in hauling dairy products from the Edgewood farm at Pewaukee, Wis., to Milwaukee, to the depot of a corporation that supplies a considerable proportion of the people of Milwaukee with milk. Manager F. C. Kiekhefer says that the truck has given complete satisfaction in this work and in constant service hauling capacity loads on heavy grades on country roads under all conditions of weather has been serviceable from every point of view.

The promoters of the automobile show at Philadelphia, Penn., will have no exhibition of service wagons in connection with it, and the display will be for six days, beginning Jan. 10, 1914.

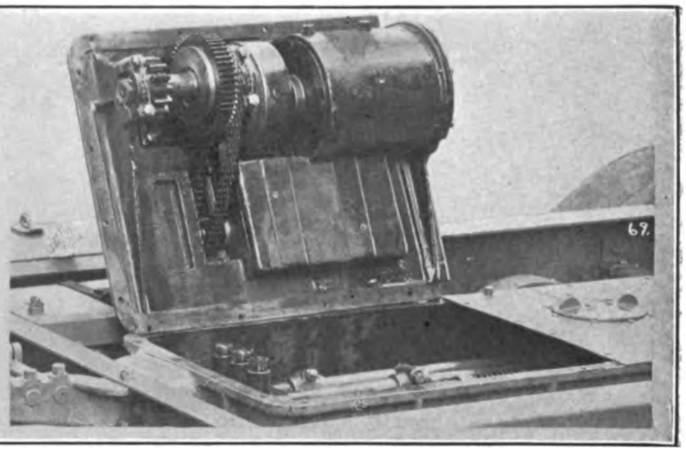
B. A. GRAMM'S TRUCK FOR 1914.

ANNOUNCEMENT is made by the Gramm-Bernstein Company, Lima, O., maker of B. A. Gramm's wagons and trucks, that it has planned to produce four sizes of machines during the coming year, and that these will be 2000 pounds, 4000 pounds, 7000 pounds and 10,000 pounds. Of these the 4000 and 7000-pound types have been built for more than a year, and these will be continued with several changes. The 2000-pound wagon was first produced several months ago, and this will be built without change from the specifications first made public. The details of the 10,000-pound truck have not as yet been made public. The claim is made by the maker that all of these vehicles have been designed with extreme care and with more than 13 years' experience in truck manufacture, the purpose being to produce what will best serve those who desire a machine of specified capacity.

The wagons and trucks are not all built to one design, for it is believed that what would be satisfactory for one type would not meet all the requirements of those who want smaller or larger vehicles, but all follow general principles of construction that have been proven with experience and have been accepted as being in accordance with good engineering. Exclusive qualities are to be found in each machine and these have been developed from practical knowledge and constant operation.



Electric Starter for B. A. Gramm's Trucks Installed on the Gearset Case.



Cover of Gearset Casing Lifted, Showing the Starting Motor and Its Drive.

The 2000-pound vehicle was described in a recent issue of the MOTOR TRUCK, and the specifications of the 10,000-pound machine have not as yet been stated definitely, while the construction of the 4000 and 7000-pound wagons is familiar to those who have knowledge of the industry. Of the last two machines mentioned it may be stated that they will continue to have the same low and sturdy construction, easy loading and easy handling being two of the qualities that were regarded as being specially advantageous and making for economy of operation. Both of these chassis were equipped with four-cylinder Continental motors, with bore of 4.5 inches and stroke of 5.5 inches, mounted on a spring-supported sub-frame, and this form of motor suspension has been found to work out in practise with extremely good results. This feature will be continued without change. The use of the dog clutch in the transmission gearset has been thoroughly tried and the endurance of the gears has proven the wisdom of this construction. The result from service has justified the use of this gearset in all the machines. The springs, of unusually large size, which are guaranteed for the life of the machine, will remain a feature of the design, as it is maintained that the quality and proportions of the springs have added materially to vehicle life and brought about minimized upkeep, this applying both to mechanism and to tires.

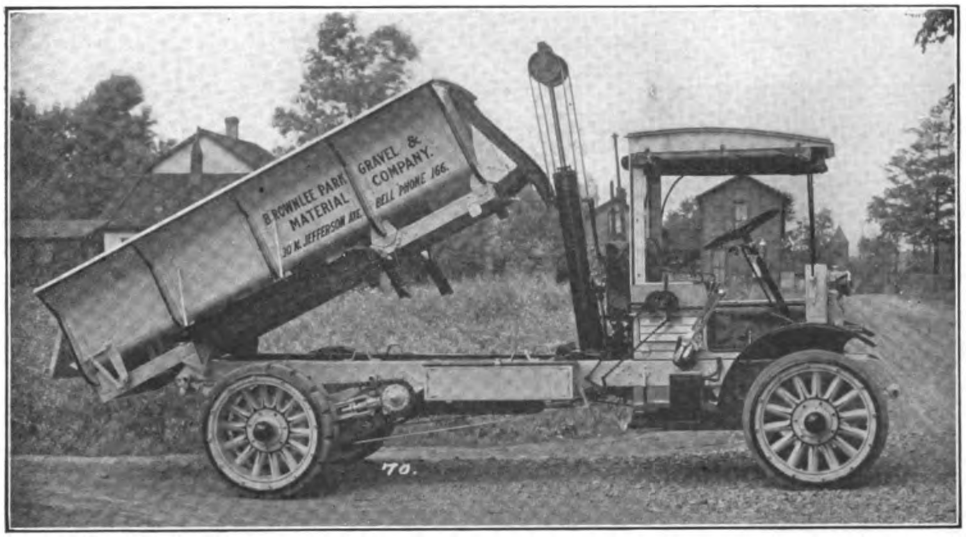
What is probably the most distinctive change has been made in the starting equipment, for this has been a feature that has attracted not a little attention to these machines. The original starting installation was, as is general with practically all vehicles so equipped, mounted on the engine case, and the motor was started by coupling it with the flywheel. After careful observation and experiment the starting motor and the generator have been installed on the cover of the transmission gearset, which location is believed to have a number of important advantages as compared with any other construction first used. The first consideration is the strain on the battery, which is by no means as severe as when the turning is done through the flywheel or the timing gears.

When the starting movement is made through the clutch, the clutch may first be allowed to slip and then gradually seats, so that the starting motor attains full speed before it is required to start the engine, and as the current demand upon the battery is materially lessened the strain upon the mechanism is decidedly reduced. With this form of installation at no time that the truck is moving is the generator idle, so that in descending long hills, where the engine is running slowly, the generator is always turning and the battery is kept fully charged.

No sliding gears are used in the mounting of the starter, all the gears being permanently in mesh. The

generator is driven by a silent chain. As will be noted from an accompanying illustration the motor and generator are mounted in the cover of the gearset case and the motor shaft carries a gear that is meshed with a pinion on the countershaft, the installation being so made that by removing the retaining bolts the entire cover and the motor and generator can be lifted out. The cover of the case forms a housing that protects the motor and generator, and it is very accessible. The starter gear and any one of the transmission dogs cannot be engaged at the same time. The starter is operated by the speed control lever. A year's experience has demonstrated that engine starters serve a very useful purpose and the claim is made by the maker that starters cannot be regarded as luxuries.

The company is now producing a dumping body that may be fitted to the two, 3.5 and five-ton trucks, the first of which was delivered to the Brownlee Park Gravel & Material Company, Battle Creek, Mich. The body is of steel and has a capacity of three cubic yards.



A 3.5-Ton B. A. Gramm's Truck Chassis Equipped with Hydraulic Hoist Dumping Body.

It is mounted on two heavy bearings at the rear of the chassis and the forward end is elevated by a hydraulic hoist driven off the main shaft. By this hoist the body may be raised to an elevation of 37 degrees and can be raised and lowered in 25 seconds. The hoisting mechanism is operated by the driver without leaving the seat, and the body may be stopped at any height, and the truck may be stopped or moving, so that the load may be distributed or discharged in a single place as desired. A safety stop limits the height of the lift and prevents damage if the power should be continued after the maximum elevation should be reached.

Claire L. Barnes, head of Claire L. Barnes & Co., with offices at Chicago, Detroit and Cleveland, will become the personal representative of John N. Willys on Jan. 1, and as such will have supervision of the Willys-Overland Company, the Garford Company and the Gramm Motor Truck Company with much, if not all, of the authority that was vested in George W. Bennett, recently deceased.

ROAD BUILDING ECONOMY.

Government Advises Minimum Grades of Lines of Least Resistance to Haulage.

The office of roads of the Department of Agriculture advises all concerned in highway building that a decided economy may be accomplished by increasing the average period of service of animals and motor vehicles, which will be automatically resultant from relocating old roads and building new so as to make the haulage along the lines of least resistance. The statement is made that to reduce the work for animals and to cause the least wear of motor vehicles and the least operating expense the highway that has the smallest grades is to be preferred, even when the distance is increased. Roads that are constructed with steep gradients, no matter if they are shorter, mean greater haulage cost because of the smaller loads and the lessened life of the animals and machines.

The farm owner may assume that roads built to this principle may take land that is valuable for crops or pasture and should not be sacrificed when other ways can be constructed that will be on land worth much less. The main question is whether the individual advantage from a road will offset the value of the property used for it, or the inconvenience of having the land divided. The officials maintain that a good road and traffic on it enhances the value of the abutting property, and the economy of a road with minimum grades is such that those using it could with reason give those who have provided the right of way an equivalent in equally good land in compensation for the property sacrificed for the common welfare.

The office is educating the people to the economic value of good roads, even at the sacrifice of better land in obtaining them. Investigation demonstrates that the building of roads has often been with reference to the preservation of farm lines rather than from scientific or economic consideration. Evidence appears to be that haulage can be increased materially and at lessened expense merely from changes of grade, while relocation of roads is with no increase of length in some cases and of but little in others.

This attention has been directed toward the development of the country roads, because on them haulage is invariably expensive and improvement can only be made according to the resources of the communities in which they are.

The Standard Truck Company of Cleveland, O., has increased its capital stock from $5000 to $50.000.

TRAILERS FOR HIGHWAY HAULAGE.

Type of Vehicle Designed for Economical Service with Motor Trucks, Developed by Troy Wagon Works Company After Much Careful Experimentation.

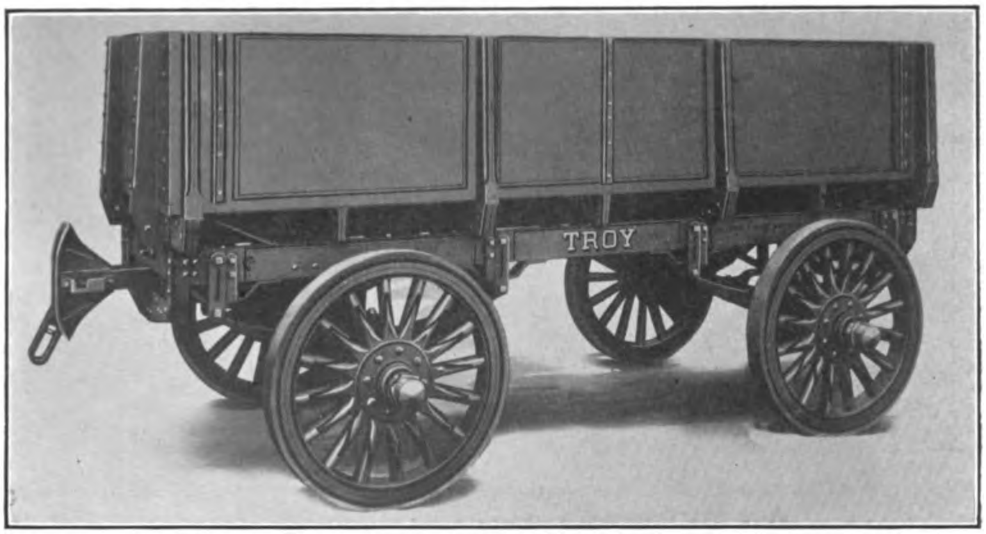
TRANSPORTATION by highway traction engine is no experiment. This form of haulage is very common in Europe, especially in England, where thousands of such engines are in service. In America construction companies have utilized steam road locomotives or even road rollers for the haulage of material, but often horse wagons have been adapted. Equipment that might be practical on smooth surfaces becomes impractical where the roads are rough or the ground is broken, and because of the strains peculiar to drawing a loaded vehicle those constructed for animal service have been found to lack endurance.

In theory haulage by trailers affords economy by increasing the load, but the speed of the train of vehicles is decreased as the number is increased. The speed is necessarily limited under the most favorable conditions, and six miles an hour may be regarded as maximum. Loaded, the probability is that this rate would not often be reached. The motor truck can be driven at faster speed than the animal wagon and the capacity is greater. Experience has taught that the largest measure of economy is in neither high speed nor extreme loads, but the best results have been obtained through keeping the machine in operation as much of the time as is possible.

Experiments have determined that the most practical use of trailers is not in large trains, but in having such a number that there need be no delay in the haulage of the tractor, and the loading and unloading can go on while the machine is in operation. That is to say, that where the distance is not too great six trailers and a tractor, for instance, can be worked very advantageously by having two at the place of loading, two at the place of unloading, and two on the road, at practically any given time.

Considering the matter of road trains, as the combination of tractor and trailers should be known, the limitation of the traction engine is evident. It can be used only for haulage of trailers, and cannot be worked productively on small jobs, in traffic or in conditions where speed is a material factor. In England and Continental Europe the traction engines are generally used on good highways and can haul large loads long distances, in which work they have been found to be very profitable when the cost of carriage is compared with the expense for railroad freightage. But unless there is practically constant work for a traction engine it cannot be regarded as a good investment. For this reason the use of motor trucks with trailers is believed to be the logical equipment for heavy haulage, for this will afford every quality desired, and the truck may be worked continually. The trailers are equipment that ought to endure for years, for the mere haulage of loads at comparatively slow speeds will bring but little, if any, deterioration.

The use of trailers has not been studied by many. Several builders of traction engines have produced trailers, but these are not of a type that can be well utilized with motor trucks. The Troy Wagon Works Company, Troy, O., after experiments extending over a considerable length of time, has begun the manufacture of trailers that have been carefully designed and developed with the purpose of obtaining the greatest utility and economy, and after trials had determined the practicability of these conveyances. The company for eight years has built trailers for use with traction engines, and for more than two years worked on the trailer proposed for the motor truck before the design was regarded as meeting with all requirements.



The Troy Trailer Chassis Equipped with a Body Having a Capacity of Five Tons, an Equipment Designed for Use with Motor Trucks.

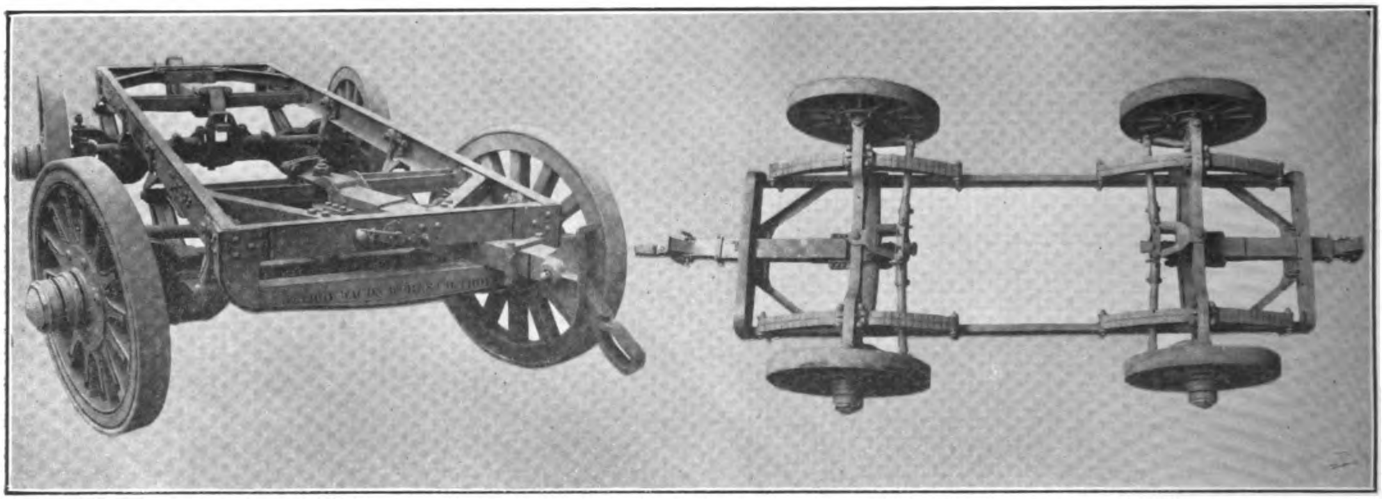
The trailer train to be practical must be controlled at all times, must be backed straight and in different curves, and the units constructed to require the smallest degree of power for haulage. Experiments justified the conclusion that the average motor truck loaded to rated capacity develops a drawbar pull equal to about half its rated load. That is, a three-ton truck in the condition stated will develop a drawbar pull of about 3000 pounds, but a team of horses will develop a maximum sustained drawbar pull equal to about 25 per cent. of their weight, or 750 pounds of drawbar pull for

a team of horses the weight of which is 3000 pounds.

Tests of different kinds established that on brick paving 50 pounds drawbar pull would draw a ton weight on level surface, but on hard country road 150 pounds drawbar pull was required for the same work. With these conclusions as a basis further experiments showed that on average roads and on average grades an average drawbar pull of 250 pounds for each ton of load carried was necessary for average work, and that a three-ton truck could be expected to draw 10 tons in addition to the load on the truck, so that the drawbar pull could be estimated as equalling that of at least three 3000-pound teams of horses. For the better demonstration of the statement curves have been plotted that show different conditions of road and the results accomplished at varying speeds. This chart will show that the estimate stated is much in excess of the charted requirements, but this apparent discrepancy is an allowance for possible exigencies not experienced in the tests. With these facts as a foundation the trailer was developed.

Having established the power that could be expected with a motor truck, the next proposition was to determine whether with trailers a truck could haul a ton of material at lower cost than without trailers, and what form of trailer could best be used. Careful tests having proven that the truck could be used economically with trailers, the design of the trailer was worked out. Five tons capacity was fixed as the limit for a trailer, and to permit turning in short radius, an imperative quality, a short wheelbase was necessary. Other qualities required were that the trailer must follow and be guided by the tractor, be either pulled or pushed equally well, that the drawbar should be attached to a flexible frame, that the wheels and axles should be flexibly connected to the trailer frame, that the drawbars should be resilient, that the drawbars should be constructed to minimize the shock of starting and stopping, that the trailers should be coupled and uncoupled quickly, that the trailers be so constructed as to be used with teams or other power in the event of necessity, that the construction be enduring, that the loss from friction be minimized, and that sufficient means for lubrication be provided.

If note be made of the illustrations the reader will learn that the Troy trailer is a chassis on which differing types of body may be mounted. The description will apply to the chassis only. The frame is mounted on semi-elliptic springs and the axles and connections with the drawbars are alike. The frame is a steel channel section construction with a cross member above each axle, with diagonals from each end member from either side of the centre to the side members. The frame end members are assembled with upper and lower sections riveted to castings, there being a slot or opening the entire length, or width of the chassis. Just back of the frame ends are the outside spring shackles, which are suspended from a heavy single bolt, and a similar shackle is located 48 inches along the frame. On these shackles the spring, 48 inches length and 3.5 inches width, is carried. The axles are heavy steel forgings, I section, but widened at the ends with openings through the axle for the spring, the seats being at the bottom of the openings.



Troy Trailer Chassis with Drawbar Swung to Afford the Shortest Turning Radius.

Bottom View of Troy Trailer Chassis, Showing the Construction of the Drawbar Control.

The ends of the axles are yoked and into these are set the pivots that carry the wheel spindles. These pivots will swing a radius of 180 degrees without the wheels. On the spindles are the heavy wooden, 36 inches diameter wheels, having 14 spokes three inches width, and fitted with steel tires four inches width. The wheels and pivots are carried on roller bearings.

From each pivot an arm extends, that is yoked at the end, and into the yokes are fitted the tiebars, these being short sections that are fitted into a rectangular member with a yoke at either side. A yoke pivoted from the axle centre supports this member and permits it to swing from side to side as the tiebar is drawn. This is necessary as in this construction the tiebars are in three sections, and are above the springs. The frame cross members above the axles support the inside ends of the drawbars, which are yoked so that there is a yoke arm above and below each member. The drawbar yokes are pivoted on the cross members. Bolted to the yoke arms are tongues that are extended into

the slot in the rectangular member in the centre of each tiebar. The drawbar is thus made a lever with the fulcrum at the frame cross member, and swinging it will turn the wheels through the tiebar and pivot arms. The angle is limited by the slide in the frame end members in which the drawbars swing or slide. Each drawbar may be locked in a centre position, and when hauled in trains the forward drawbar is free and the rear drawbar locked, and the trailers will follow in the exact radius of the turn made by the tractor. When backing the forward drawbar is locked and the rear drawbar is free. That is, when moving forward the effect is precisely the same as with any vehicle with a fixed rear axle. When backing the result is as though a fixed rear axle vehicle were turned end for end. Backing is accomplished by a man swinging the rear drawbar of the rear trailer to the desired angle.

The drawbar heads are steel castings that, when installed, have a vertical slot or opening in which the coupling link may be raised or lowered an angle of 45 degrees to the direct line of draft. These heads are so formed that they will contact and will not "ride" each other because of inequalities in the road surfaces. The drawbar is a rectangular tube of heavy section metal into which the shank of the drawhead is telescoped. This contains a helical spring that will compress when 200 pounds pressure is reached, and this will resist compression up to 2000 pounds pressure, when it will be fully compressed. This spring is so installed that the compression resistance is equally effective when the trailer is drawn or pushed. This affords a degree of resiliency that minimizes the strain upon the trailer and the tractor or truck drawing it.

The drawbar affords resiliency between units in the trailer train. The spring shackles are so designed that when at the lowest point stops prevent reflection, but when deflected the springs will swing backward until the stops on the front or drawing ends of the springs are seated, when the rear or free ends will have movement. All the drawing or pushing strain is exerted upon the springs, and the shocks of road obstructions are absorbed by them. The tongues of the drawbars have a vertical movement in the rectangular members of the tiebars corresponding to the deflection and reflection of the springs, and there is no resistance and no strain. The coupling links are so constructed that they are pivoted in the centres so as to have a sidewise movement from the pivot, this relieving strain when hauling, but when backing in multiples or holding on descending grades the flexible joints of the links are within the drawheads and there is a rigid connection.

The specifications of the trailer, which has a maximum capacity of five tons, are: Weight of chassis, 3330 pounds; length of chassis frame, 142 inches; width of chassis frame, 41.5 inches; tread (from centre to centre of tires), 64.5 inches; wheelbase, 81 inches; length overall, 173 inches; width overall, 84.5 inches; height of top of frame above ground, 34.5 inches; road clearance, 17 inches; wheel diameter, 36 inches; tire width, four inches; length between steering arms, 58 inches; length of springs, 48 inches; spring width, 3.5 inches; diameter of wheel spindle, 2.875 inches.

PRACTICAL PROMOTION.

Electric Vehicle Association Aiding Petitioner for New York 'Bus Franchise.

The value of organization and the possibilities for directing endeavors along practical lines is demonstrated by the activities of the Electric Vehicle Association of America, which is aiding the People's Five-Cent 'Bus Company in a campaign in New York City to obtain a franchise to operate 20 lines of motor omnibuses in different parts of the municipality. The petition is pending before the board of estimate, and the purpose of the company is to afford service with electric vehicles for sections which are not now well served by transportation companies.

The company purposes to divide the city into zones, the fare in each to be five cents, but passengers going the length of the city will pay two fares. The plan is regarded by the promoters as having material advantages for the people, and the claim is made that as most of the 'bus rides would be comparatively short distances the zones and the five-cent fare will give cheaper transportation and extremely efficient service.

The petition has been opposed by street railways and existing omnibus lines, a statement being made in behalf of the opposition that any increase of motor trucks throughout the city would endanger the lives of pedestrians. President Frank W. Smith of the Electric Vehicle Association, representing that organization at a hearing, controverted such a contention by emphasizing the simplicity of control and ease of operation of electric machines. He stated that within New York City were 500 enthusiastic owners of electric trucks, using 2100 vehicles, and that these owners would willingly testify before the board of estimate as to the great safety of their machines, or, if the board elected, his association would gather the facts and present a brief.

At this same meeting Miller Reese Hutchison represented Thomas A. Edison, who was confined home by a cold, and read this letter from Mr. Edison: "I believe that for traction in cities the electric motor will displace all other motors. Already it has displaced steam on street cars, elevated railways and subways. It drives all of the elevators and most of the machinery in the city. If 'buses are desirable for intercity traffic, the electric is the only practical one. It is noiseless, has half the destructive effect of a gasoline engine, and can be stopped quicker than the gasoline vehicle, with the added economic value of much cheaper operation".

The International Motor Company has sold the building at 532-40 Atlantic avenue, Brooklyn, N. Y., formerly occupied by Mack Bros. Motor Company.

The Motor Truck
Devoted to Motor Driven Business Vehicles of All Classes.

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Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

Entered as second class matter, February 25, 1911, at the Postoffice at Pawtucket, R. I., under the Act of March 3rd, 1879.

NIGHT HAULAGE IN CITIES.

The proposal that congestion of highway vehicle traffic in cities of considerable proportions be relieved by doing more or less of the haulage at night, appears to be the only logical solution of a problem that is becoming more and more pronounced. There is no question that street widening is too costly to be seriously considered, and the loss from the idle time of men and vehicles is such that business organizations must seek relief. Traffic regulation has accomplished a great deal, but the result has been chiefly in making the streets safer for pedestrians.

Beginning early in the morning, the traffic usually increases until its height is reached late in the afternoon, and from 6 in the evening until 4:30 the same thoroughfares are practically deserted. If haulage were distributed over the 24 hours of the day there would be a decided increase of productive time, and there would be comparatively little loss. This could apply to wholesale establishments, to railroad terminals and piers, to delivery of coal to manufactories, shops and buildings, and to transfers of freight and baggage, and would mean adjustment of hours of work more than anything else.

Night haulage would mean greater safety for the public, for a considerable part of the time there would not be more than a small per cent. of the pedestrians in the streets, while the diminution of traffic would reduce the dangers that now exist by day. Not only this, the use of the highways continuously would obviate many of the conditions that have brought about regulations that are regarded as hardships.

"SERVICE" AND "MAINTENANCE".

The manufacturers of motor service vehicles should establish precisely what is meant by the term "service". The word as it is generally used is decidedly indefinite, and because of this fact the purchaser of a machine has no knowledge of the responsibilities of the manufacturer, the agent or himself. The maker as a rule makes a guarantee against defective material or faulty workmanship within a stated period. The salesman makes promises and the agent assumes obligations because he considers it wise to do so, and the buyer may be justified in expecting supervision, advice, and whatever he can secure beyond the assurances of the guarantee, including damage resulting from his own ill judgment or the incompetency or neglect of the driver.

The experience has been that many men expect maintenance as well as service, and the company or agent makes concessions that are not warranted simply to prevent discontent of the owner and avoid criticism that is assumed would be adverse to future business. The buyer of a motor truck will permit abuse and neglect and then complain that he has been made a victim in purchasing, and will seldom admit that his own judgment was at fault. Were there a rigid definition of service, and this lived up to by manufacturers and agents, and the responsibilities actually placed, there would be far less criticism and dissatisfaction.

TRUCK OWNERS' ORGANIZATIONS.

That owners of service wagons and trucks have failed to organize for the promotion of their interests is not strange when one realizes that there has been no general inclination of those concerned in highway transportation to unify in organizations that might be productive of material benefit. Master teamers have formed associations in some cities, but these are the exception and not the rule. The principal purpose to be obtained is united action in the event of controversy with labor. There are very large possibilities, however, for owners of vehicles who wish to apply economic methods and improve their service, and there can be no better manner of acquiring knowledge than by exchange of experience and by adopting uniform policies and means of meeting conditions that may be met with.

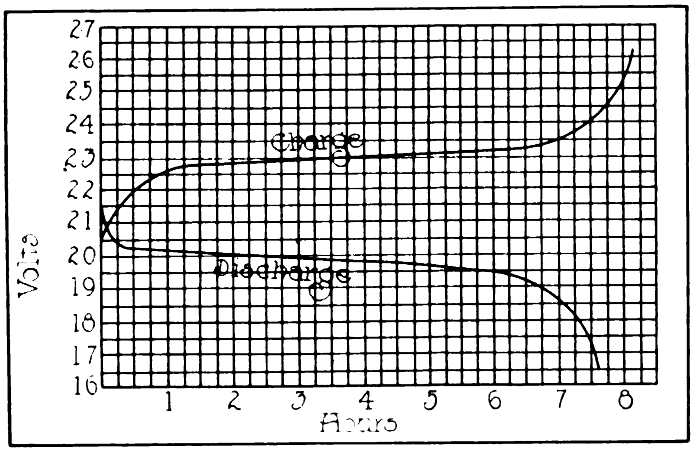
There are innumerable problems that could be practically dealt with, and the influence of an organization could be exerted with decided results where the endeavors of one or several would fail. As the use of service vehicles increases legislation will be an exceedingly important subject, and as legislators as a rule have excellent machinery and carefully developed resources, the futility of opposing them without organization is apparent.

ELECTRIC VEHICLE PRACTISE.

Tests of Electrolyte to Determine Metallic and Other Impurities---Influence of Temperature on Cell Capacity---Conditions Affecting Battery Efficiency---Internal Resistance and Local Action and the Results of Self-Discharge.

By William W. Scott.

WHEN this can be done, the electrolyte, before it is placed in the cells, should be tested for impurities, and it is good practise to test it from time to



Curves Showing the Characteristics of Voltage Increase and Decrease with Charging and Discharging.

time during the period it is used. The knowledge that the electrolyte is pure is assurance that there will be satisfactory results from the cells and minimum deterioration. While the average batteryman may not be a chemist, he can detect conditions that will cause destructive action. The tests should be made for the traces of metals or chlorine in their order of importance, which can be accepted as follows:

When an electrolyte is placed in a cell containing a regular element and the cell is on open circuit, if gassing should continue for a considerabe length of time one may safely assume platinum is present. The slightest trace of platinum will cause a discharge from the negative plates. If this test justifies the belief that platinum is in the acid a more complete examination can be made.

The presence of iron can be ascertained by neutralizing a solution of two parts acid and one part water with ammonia or caustic potash in solution, which may be boiled with a volume of hydrogen peroxide or nitric acid equal to about one-thirtieth of the specimen of electrolyte. The boiling will transform the iron into a ferric state, and if a sample be placed in a test tube and caustic potash solution or ammonia be added so as to make the sample alkaline, a brownish red precipitate will form if there is any considerable volume of iron present. A more delicate test can be made by adding several drops of prussiate of potassium to a sample of the boiled electrolyte, which will cause it to become red in color.

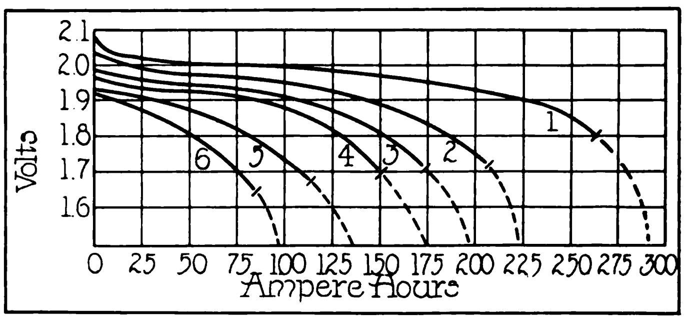
A satisfactory test for chlorine is made by preparing a solution by dissolving 20 grams of nitrate of silver in 1000 cubic centimeters of distilled water. A few drops of this solution may be dropped into a specimen of the electrolyte, and if chlorine is present, as chlorides, the electrolyte will change to white from the precipitation of silver chloride. If the precipitate is milky, but a small volume of chlorides is in the electrolyte. If it becomes curdy the volume of chlorides is much larger.

Several tests may be made for nitrates, but the best is by placing some chemically pure copper filings in a test tube and partly filling it with the electrolyte that has been tested and found free from chlorides. The tube should be corked, and through the cork should be introduced the end of an S shaped glass tube. One turn of the tube will form a trap, and this should be filled with a solution of ferrous sulphate. If the tube is heated by a bunsen burner the nitrate vapor will be forced to pass through the solution of ferrous sulphate and this, absorbing the nitrates, will be changed to a very dark brown color.

The addition of a solution of ammonia to electrolyte will, should there be copper present, cause a bluish-white precipitate to form, but should an excess of ammonia be added and the solution become alkaline, the precipitate will be obliterated and the fluid will become dark blue in color. This test will show .002 per cent. copper. Other tests may be used, but this will be sufficient.

If lime water be added to electrolyte a black precipitate will form if mercury is present, and the addition of a solution of potassium iodide will cause an olive green precipitation.

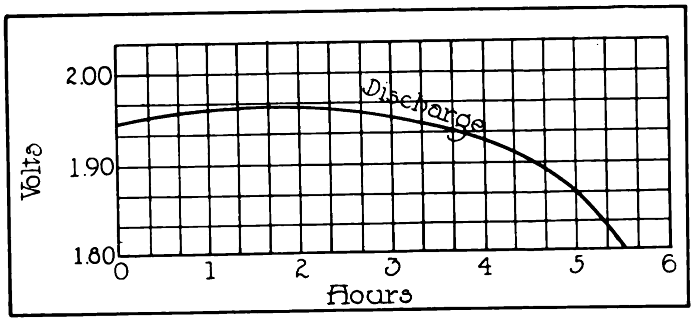
A very good test for arsenic can be made by taking a specimen of acid and reducing it by the addition of



Curves Illustrating the Voltages and Duration of Discharge at Varying Rates.

about 80 per cent. of distilled water, and to this solution adding about a tenth of its volume of concentrated hydrochloric acid. In this a tiny coil of copper wire,

polished to brightness, should be deposited, and the solution boiled for 15 minutes. The copper will become brown or black if arsenic is in the solution.



Curve Showing the Slight Rise of Voltage at Beginning of Discharge After a Considerable Period of Rest.

If acetic acid is suspected the electrolyte should be neutralized with ammonia and ferric chloride added. Should the solution become red and the addition of hydrochloric acid bleach it, an appreciable quantity of acetic acid is present.

To determine the existence of organic matter an analysis is preferable, but it is possible to reach a practical result by boiling electrolyte in a beaker to a point where it is so concentrated that white fumes will be given off by the acid. The discoloration of the fluid will indicate that there is organic matter in sufficient quantity to justify greater attention.

In making the tests care must be observed to prevent the introduction of impure matter with the water or the chemicals used. If the solution proves to be free from platinum, iron, chlorine and nitrates, the electrolyte may be assumed to be safe for use, but a better safeguard is to make all and be absolutely certain.

The statement has been made that in the designing of a cell the volume of electrolyte is kept as small as is practical and good results can be obtained, because of the desire to minimize weight, but the greater the volume the better, as a rule, is the efficiency of the cell.

It has also been stated that in the computations of engineering data the temperature is generally taken as 60 degrees Fahrenheit, but many engineers vary from this and having corrected their tabulations for density at higher temperatures follow their own formulae. These tabulations serve a very useful purpose, as they can be made to cover temperatures from 32 to 120 degrees, and efficiency of the electrolyte can be ascertained at a glance. In some instances curves are plotted that cover both temperature and density.

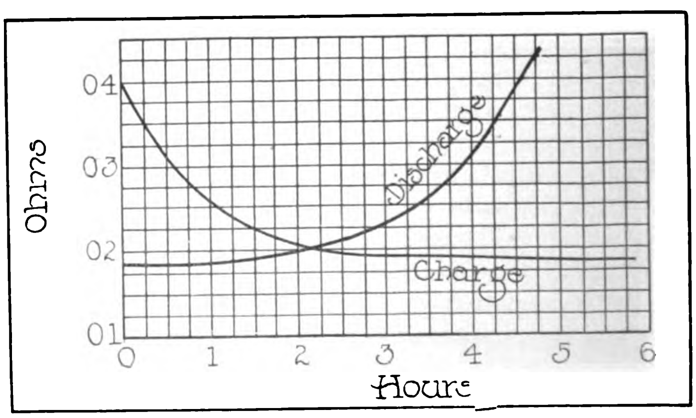
As a base for computations a temperature of 60 degrees may be taken, and as with this the following densities can be assumed with acids of 1.835 and 1.842 specific gravities, the range showing the proportions of acid by weight:

Specific Gravity	Weight in Pounds a Cubic Foot	Per Cent. of 1.835 Acid	Pounds of 1.835 Acid in One Cubic Foot	Per Cent. 1.842 Acid
1.151	71.79	22.00	15.79	20.570
1.160	72.35	23.25	16.82	21.739
1.169	72.91	24.50	17.86	22.907
1.179	73.53	26.00	19.12	24.310
1.188	74.10	27.25	20.19	25.479
1.198	74.72	28.50	21.30	26.647
1.208	75.34	30.00	22.60	28.050
1.218	75.97	31.25	23.74	29.219
1.229	76.65	32.75	25.10	30.621
1.239	77.28	34.00	26.28	31.790
1.250	77.96	35.50	27.68	33.192
1.261	78.65	37.00	29.10	34.595
1.272	79.33	38.37	30.44	35.876
1.283	80.02	39.75	31.81	37.166
1.295	80.77	41.25	33.32	38.569
1.306	81.46	42.62	34.72	39.850
1.318	82.20	44.00	36.17	41.140

It should be interpolated that, while 1.842 is the specific gravity of sulphuric acid and is the standard for all electro-chemical determinations, 1.835 is the specific gravity of commercial sulphuric acid, and this is the standard that may be used in mixing electrolyte.

Manufacturers of batteries usually have their own standards of electrolyte mixing, and an example of this may be stated where the normal maximum density of a battery is fixed as 1.285 at 85 degrees Fahrenheit, but when the cells are shipped they have a specific gravity of 1300, which is the highest that is permissible. The charging voltage will be less as the temperature of the electrolyte rises, and this has been proven to be as much as .18 volt by the increase of the temperature from 57 to 113 Fahrenheit. The greatest loss (.12 volt) was between 57 and 86 Fahrenheit temperature, but this loss cannot be sufficiently established to graduate it with accuracy. The discharging voltage will increase with the increase of temperature. Careful observations have proven that the amperehour and watt efficiencies decrease with the increase of temperatures. The considerable increase of temperature has the effect of increasing the porosity of the active material and through the greater activity of the electrolyte the discharge capacity of a cell is somewhat enhanced. The manufacturers and their engineers generally agree that the temperature of a cell should not be permitted to rise above 110 Fahrenheit. With the increase of temperature the resistance of the cell decreases and the local action will increase.

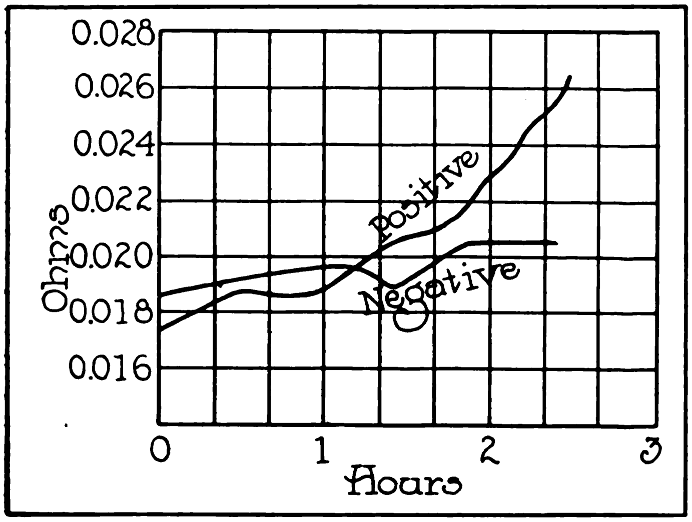
The efficiency of the lead-acid cell is dependent upon a number of conditions, which include the charging rate, the discharging rate, the internal resistance,



Curve Demonstrating the Decrease and Increase of Internal Resistance of a Cell with Charging and Discharging.

the volume, density and diffusion of the electrolyte; the period of time between the end of discharging and beginning of charging, the absence of local action and

the temperature, and the result may be expressed in the ratio of the useful current discharged, the standard being the current required for charging. The ratio



The Variance of Resistance Developed with Positive and Negative Plates During Discharge of a Cell.

of ampere-hours discharged to ampere-hours charged indicates the ampere-hour efficiency, and in a similar manner the ratio of watt-hour efficiency may be expressed.

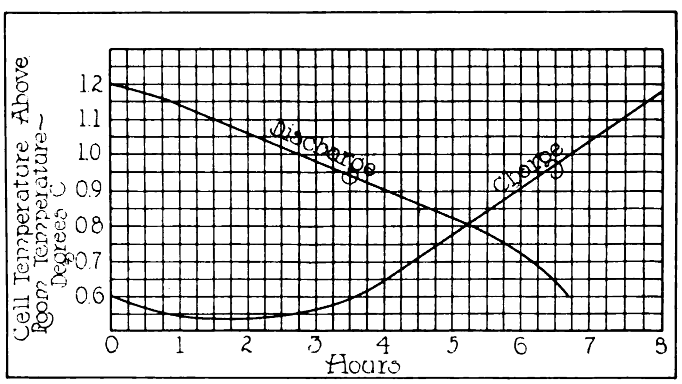
The reduction of efficiency of a cell from losses of energy may be the result of resistance loss, internal discharge from local action, the evolution of gas at the conclusion of discharge, and irreversible chemical reactions. In consideration of these, resistance may be first discussed. So far as the cell is concerned this loss during discharge may vary from two per cent. at low rates to five per cent. at high rates, but is not often in excess of this figure. The internal resistance of a cell will result from the resistance of the metal forming the frames of the plates, the resistance of the active materials of the plates, the resistance of the electrolyte saturating the active material, and the resistance of the electrolyte, and of these the most important is the resistance of the active material and the electrolyte contained in the pores of the plates. The others are of minor consequence. The statement as to loss during discharge is based on the supposition that the cell is in good condition.

As has been stated, the variation of temperature will influence the resistance, there being a gradual decrease as the temperature increases, from the seemingly greater porosity of the active material and the better diffusion. The results of charge and discharge should be remembered for a moment, and it is evident that in charging, assuming that a reasonable condition of sulphation is to be dealt with, the resistance will be greatest at the beginning. Careful observation has established that this resistance will diminish gradually until a minimum is reached, and from this point on until the end of the charge there will be but very little change, though there will be a slight diminution. In discharging the resistance will be least at the beginning and it will increase as the sulphation progresses, until the cell is completely discharged, or at least so long as discharge continues. The best authorities maintain that when a cell is charged the resistance is practically all from the electrolyte, but in discharging the resistance is dependent upon the degree of sulphation, and it may be from four to five times as much as at the maximum charge. The greatest change is in the positive plates, in which the resistance is increased constantly, but the increase in the negative plates is slight in comparison. As the rate of discharge is increased the internal resistance of the positive plate becomes more pronounced than when the rate was low. This may be attributed to the density of the acid in the pores of the active material, the degree of the combination of lead sulphate with the lead peroxide, the thickness of the formation of lead sulphate on the surface of the plates, and the reduction of the acid density. With high discharge rate the conditions which cause greater internal resistance are the more quickly reached and they are carried to a greater degree than with a low rate.

In charging, if the form of the plates is such that there will be accumulation of gas on them, there will be increase of internal resistance, but in addition to the ohmic resistance the effects of polarization, in combination with the resistance, is to increase the potential when charging and decrease it when discharging.

Loss of energy from internal discharge or local action may result abnormally from current that flows from one part of a plate to another from a difference in potential that may exist in different parts of the same plate, from impurities that are in the cell, while normal internal discharge may result in a cell in which there are no impurities, but will take place only at the end of a discharging period. The normal internal discharge is usually of little importance and is seldom of extended duration. As generally applied in battery engineering the term "local action" refers to more or less continuous discharge, which must result in sulphation of the plates and a consequent deterioration and reduction in capacity.

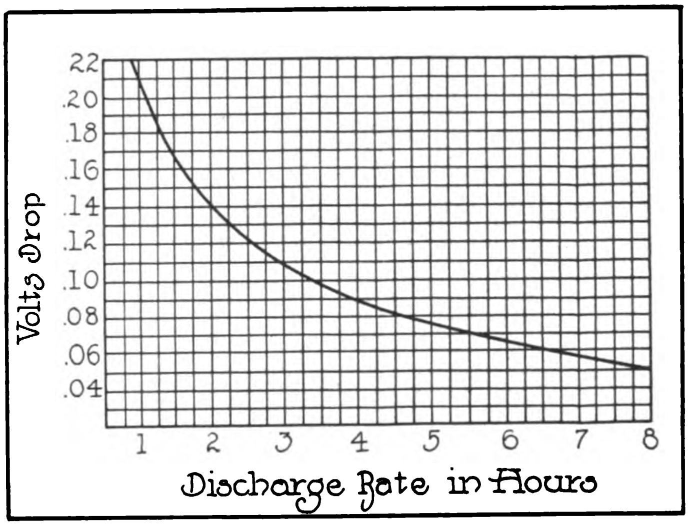
The reader will recall the statement that when an element is placed in electrolyte, and the cell be not



Cell Temperature Variation During Charging and Discharging in a Room with a Constant Temperature.

charged, sulphation will take place. The reason is that the sulphuric acid will transform the surface, or cover it with a formation of lead sulphate that is

similar in effect to a plating or sheet of insulating material, and the effect of the charging is to reduce the sulphation and increase the density of the electrolyte.



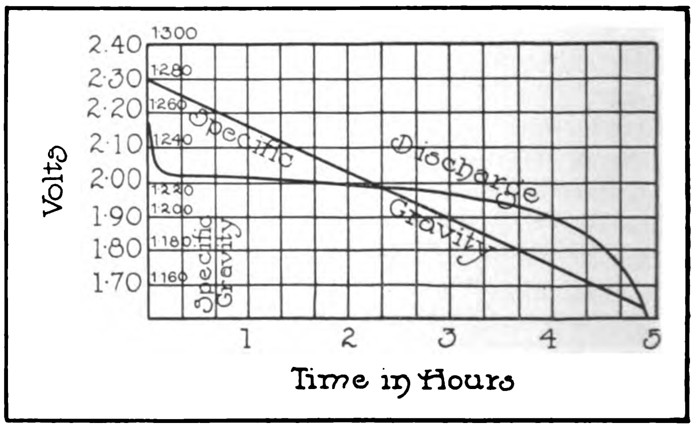
Decrease of Cell Voltage Is Dependent upon the Rate of Discharge, as Illustrated by This Curve.

Beginning with the discharge this sulphation goes on until the end of the function. Concentration of the acid and the increase of temperature will intensify local action. High electrolyte density will cause sulphation of the negative plates, for these electrodes are more easily affected than are the positive, as the sponge lead is necessarily cellular in structure and the metal has a greater electro-positive value. A fully charged negative plate removed from the cell and exposed to the atmosphere will heat and harden through rapid oxidization.

The negative plate can usually be assumed to be free from impurities in the manufacture or formation, but there is a possibility of acids or their salts, used in the production of the positive plates, not having been entirely eliminated and becoming active when the plates are submerged in electrolyte. The result of the presence of these substances is the increase of cell capacity, but the plate will rapidly deteriorate. A reasonably safe assumption is, should the capacity of the cell increase after it has been charged and discharged 30 times or more, that the cause is an acid or salt of an acid that, in combination with the electrolyte, is attacking the positive plates. When conditions are normal the chemical effect of the electrolyte on the lead peroxide of the positive plates is not a matter of importance. It is possible, however, for superoxides to be formed by charging that will be of consequence, for the peroxide will be reduced to a lower oxide.

The elimination of lead sulphate from the pores of the active material of a pasted or Faure plate and the permeation of these pores by the electrolyte, may cause a couple between the active material and the frame of the plate, and there is greater activity where the frame is of pure lead. This result is not usually of a character to be of importance. If such a condition existed it would continue until there was a sufficient formation of lead sulphate to protect the frame.

Particles of metal in the electrolyte, introduced with acid, can bring about local discharge on the positive plates if the metals are easily oxidized. When such impurities exist these carry oxygen from the positive to the negative plate and thus cause the charge to be transferred, the result being the eventual internal discharge of both plates. This condition obtains with all metals that are not precipitated on the positive plates. Deposits of metallic particles on the negative plate results in the two metals forming a tiny cell that is in short circuit. In the event that the metallic particle has greater electro-positive strength than the sponge lead of the negative plate, a current will flow from it through the electrolyte to the sponge lead, and the result is that hydrogen is released from the negative plate and it becomes more strongly charged. If the metallic particle has greater electro-negative strength than the negative plate the current will flow from the plate through the electrolyte to the foreign metal and hydrogen is released at the metal and oxygen is released at the plate. The result is the formation of lead sulphate and the negative plate is consequently discharged. In other words, when an active couple is established on the negative plate the result may be charging or discharging, the conditions necessary to bring about this result being the actual contact of the metals and a difference of potential that will cause decomposition of the electrolyte, as well as the influence of the electrolyte upon both the foreign metal and the plate. The influence of metals varies, that of platinum being the greatest, and the statement of an undoubted authority is that as minute a particle as one one-millionth will cause internal discharge. The elements most to be feared besides platinum are iron, copper, arsenic, manganese, antimony and mercury. When a plate has been discharged by platinum in the electrolyte its efficiency can only be restored by reversal of the current, but other metals deposited on the negative plates may become covered with deposits of sponge lead and in time lose their harmful influence. A very good indication of the presence of a foreign metal in a cell is the liberation of hydrogen gas from



Decrease of the Specific Gravity of a Cell with the Discharge.

the negative plates when the cell is on open circuit.

Hydrochloric acid in a cell will form chloride of lead, which is later transformed to lead sulphate, and

results in discharge of the positive plates, and the transformation of the lead chloride releases the acid, which is free to renew its injurious influence and repeat the process. A sufficient volume of this acid will cause sulphation of the sponge lead and a similar result as with the negative plates, but the chemical action of the cell and the action of the electrolyte will neutralize the acid, if but a very small proportion exists. Arsenic will have a discharging influence upon the negative plates for a short time if in a cell, but will not affect the positive plates. The metal is either precipitated or it is liberated as arsenated hydrogen. Nitric acid will cause corrosion of the positive plates and it will attack the negative plates, forming nitrate of lead, which is converted into lead sulphate, releasing the acid to continue its destructive influence, and the consequent discharge of the negative plates. Ammonia will cause reduction of capacity and the formation of crystals by "creeping" about the edges of the cells. Iron is one of the most harmful of metals to be introduced into a lead-acid cell, for when in sufficient volume it will cause discharge of both the negative and positive plates, and its influence will continue so long as it remains in the electrolyte. Iron serves as a carrier of oxygen, and when in contact with lead peroxide it will form in the electrolyte a ferric sulphate. In this state it is attracted to the negative plates, where it will liberate oxygen and will discharge the negative plates and change to ferrous sulphate. As ferrous sulphate it is attracted to the positive plates, and there the process stated is repeated indefinitely. The action of manganese salts is identical with that of iron in carrying oxygen, the salts being changed in the electrolyte to permanganic acid or manganic sulphate. The permanganic acid carries oxygen from the positive plates to the negative, and after causing oxidization and forming manganic sulphate, it returns to the positive plate, where it releases the oxygen and is changed to acid form. This influence is repeated indefinitely.

(To Be Continued.)

The Warnes law that was to become effective Jan. 1, 1913, which imposed a registration tax of from $5 to $18 on different classes of automobiles and motor wagons owned by citizens of Ohio, has been declared unconstitutional as the result of a suit filed against the secretary of state by C. C. James, president of the Ohio State Automobile Association. The opinion of the court was that the measure was designed for revenue instead of merely affording protection for people and property. This decision will for the time being, at least, assumedly continue the law now existing. The opinion is of large importance to the owners of vehicles used for business purposes.

The annual convention of the American Road Builders' Association took place at Philadelphia, Penn., Dec. 9-13, and in connection with the meeting was an exhibition of road building machinery.

BOSTON MOTOR TRUCK SHOW.

Only Exhibition of the Kind in 1914 Has Large Business Possibilities.

The annual exhibition of the Boston Commercial Motor Vehicle Association will take place at Mechanics' building, Huntington avenue, March 17-21, continuing for five days, this allowing one business day between the conclusion of the pleasure car show on March 14 and the opening of the display of service machines. This will be the third successive annual truck show for Boston, and with the experience of the previous years the show committee believes that there will be an exhibition far superior to any yet held.

This will be the only exclusive motor truck show held during 1914, and while Boston exhibitions have always been national in character, this quality will be more pronounced than ever. The Boston dealers' organization is practically the only body in America that has continued display of service wagons, the Automobile Chamber of Commerce abandoning those held in New York and Chicago. Boston is recognized as the commercial centre of New England and the truck shows have invariably attracted people from all sections, with the result of numerous sales and the development of a great deal of prospective business.

The show will be under the management of Chester I. Campbell, who has directed every exhibition of motor vehicles held in Boston in the past 10 years, and he has neglected nothing that would in any way contribute to the attractiveness of the show to the business man. The show will not have the features that are characteristic of pleasure car exhibitions, but it will decidedly appeal to the man studying or investigating motor vehicles, for he will have opportunity to examine practically every machine sold in New England, make such comparisons as may be desired and obtain data that will be distinctly valuable.

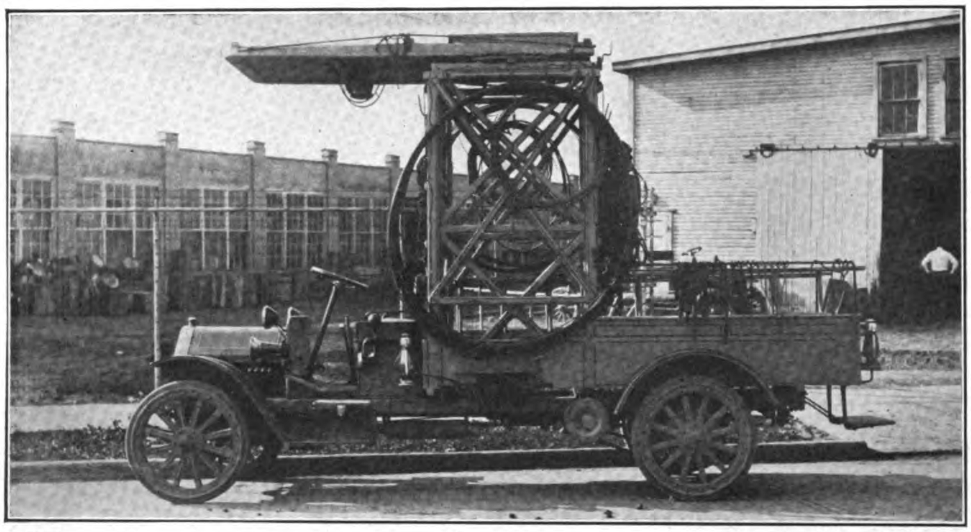
The show will continue five full days, and it will be at the end of winter, when the business men are planning for the activities that will be begun with the advent of warmer weather. Given over wholly to business vehicles and accessible from every part of New England in a few hours, it is expected that it will be especially productive. The possibilities for business at this show are regarded as extremely good, and this can be applied to practically any make of machine.

The M. Rumely Company, Laporte, Ind., has appointed as general manager of operations, Henry A. Waterman, who was general superintendent of the Milwaukee works of the International Harvester Company, and in charge of the designing and experimental work on tractors and internal combustion engines. Mr. Waterman, after being graduated from the Massachusetts Institute of Technology, was for two years with the Brown & Sharpe Manufacturing Company, Providence, R. I., as engineer.

FEDERAL TRUCKS FOR EMERGENCY WORK.

THE utility of the motor vehicle is accepted without question by business men and its economy is understood, but the fullest value of motorized equipment is not always realized by those who own it unless the conditions are studied and it is used to the best advantage. An admirable example of the possibilities is that of the Detroit United Railway Company, which operates the trolley surface lines in the city and vicinity, and which must provide means for maintenance of its service and restoration of lines whenever interruption happens. Time is extremely valuable when work of this character is needed and equipment that will economize it is not only desirable but is necessary.

For years horses were used by the department maintaining the street construction and lines, and believing that a better organization was possible, Ellsworth J. Burdick, superintendent of power, who has oversight of the power stations and the street construction, worked out a plan for using motor wagons. It was necessary to maintain a wagon to respond to fire alarms and to derailments of cars, and another to restore broken wires and make other repairs. He wanted machines that could be driven rapidly and which would have endurance, as well as sufficient capacity to carry tools and apparatus that would be needed in the event of any emergency that could be foreseen.



Federal Truck Equipped for "Overhead Trouble" Service and Used by the Detroit United Railway Company.

Detroit Street Railway Equipment.

He planned a central station where the apparatus he purposed to use could be located in readiness for a summons, and the service of two machines, selecting two Federal wagons. The station is at St. Antoine and Woodbridge streets, and here the equipment is always in readiness unless it is absent because of calls. The service is operated much the same as is a fire department, the calls being received by telephone and the wagon that is summoned being sent away almost instantly. Each wagon has a crew of four men, who are on duty day and night, seven days a week, sleeping in the house and being absent only for meals unless relieved. In this manner the fullest value of the men and machines is realized and work is done with celerity that is surprising. This is probably the only public service corporation that has adopted this plan, but the results have been extremely satisfactory.

One of the wagons is used for what is known as "ground work" and while it is a standard Federal chassis the body was built to designs submitted by Mr. Burdick, who planned his equipment requirements and the best means of carrying it. The body of this wagon is 11 feet length and is about five feet width, being built on a frame. This body is installed on the chassis so that the floor is about 30 inches above the ground. Five feet back of the driver's seat is a partition. Over the rear wheels are two tool boxes, each three feet length and nine inches width. Forward of the partition are carried bars, tackle, jacks, rope and tools used for moving and lifting derailed cars, this load weighing about 1100 pounds. The wagon is sent wherever a car is off the rails or is inoperative.

This wagon also is sent to all alarms of fire within a mile circle of the station, and to any fire that is in a street in which there is a track of the company. When the machine is sent out to fires it carries in addition to the equipment stated a steel tube and chain cradle that contains other tools and fitments that weigh about 2100 pounds. This cradle carries camelbacks and jumpers for use in crossing hose stretched across rails, and with its contents it is suspended from the ceiling by an air hoist. When the wagon is in the station it is under the cradle, so that in the event of an alarm the cradle is lowered into the space behind the body partition and without loss of time it can be dispatched. The machine is governed to 18 miles an hour instead of the regular 15 miles, and is fitted with cellular tires. Fast time is made by the crew, and frequently the machine is at fires ahead of apparatus.

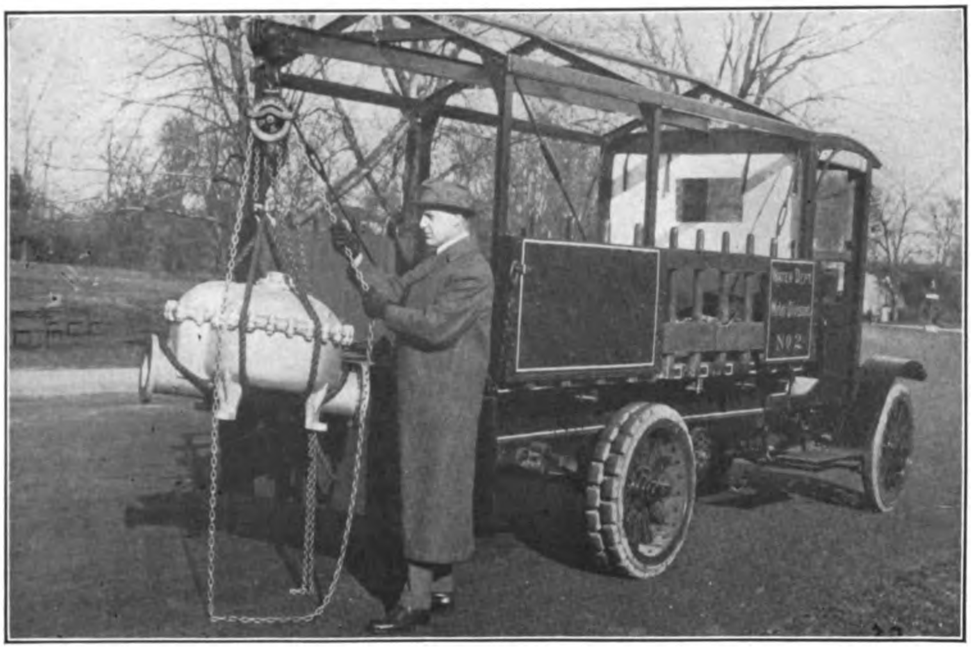
The second wagon is a standard Federal chassis equipped with a body designed by Mr. Burdick, and this is used exclusively for work on overhead construction, and it is sent to any point in the city where it is needed by the same system as the other. This machine has an open body and on this is mounted a standard Trenton tower for working on the wires. The tower is 10.5 feet height, but it may be extended to 17

feet. The equipment consists of rope, wire in coils, bars, wire guys, turnbuckles, wire cutters, blow torches, hand tools of all kinds, and whatever might be necessary for construction or repair work. Despite the tower the centre of gravity is low. The machine has the same speed as the other and it is rushed around the city in fast time.

Both machines have been in use about a year and have been in that period very thoroughly demonstrated. The system has worked out admirably and a service is afforded that would not be possible with any other form of equipment.

St. Louis Water Department.

Quite as interesting an installation has been developed by the St. Louis, Mo., water department for the use of its meter division. As it is necessary to handle a considerable number of large meters and these are both bulky and heavy, much time was required for loading and unloading, as well as the setting, and to economize the time a motor wagon equipment was devised. A Federal chassis was purchased and an open body installed. On this was built a frame with three 2.5-inch T bar steel stanchions at either side with a truss construction above them, with a four-inch I beam supported in the centre of the frame and extending 30 inches beyond the end of the body at the rear. On this I beam is mounted a half-ton chain hoist that can be moved from one end of the beam to the other. The frame is comparatively light, but it is given rigidity by gussets, ties and by diagonal rods and turnbuckles that are extended from the upper ends of the front and rear stanchions to the centre of the flooring, and is also given support by the sides of the body. The platform is 11 feet length and five feet width. The body, frame and equipment weigh 1500 pounds.



Federal Truck Fitted So Driver May Handle Half-Ton Meters Without Help, in the Service of the St. Louis, Mo., Water Department.

The largest meters used by the department weigh about 1000 pounds, and there are sizes that are graduated from that weight down. Because of the form the meters are difficult to handle without equipment, and with the idea of one man loading and unloading the heaviest of these, F. L. Beck, engineer of the meter and tap division of the St. Louis water works department, designed the body and the hoisting frame. When large meters are to be handled the truck is backed to the meter in the store house, a rope sling is passed around the machine and with the hoist it is raised to a height that will clear the truck platform and lowered. The truck can carry three of the largest meters and these can be moved from one place to another as easily as the smallest sizes. The truck may be backed to a sidewalk and the meters loaded or unloaded. The truck carries a meter puller that is used for loosening the flanged joints, this tool being designed to expedite the work and economize the time of the vehicle and its crew. The truck is driven from 15 to 30 miles a day, transferring men from one job to another, and according to the records of the department six men working in pairs with the truck can do as much work as 10 men working with five single-horse wagons. The saving possible through the use of the machine is considerable.

MILLER'S CATALOGUE.

Chas. E. Miller, with home office at 97-103 Reade street, and 14 branch stores located in the principal cities of nine states, has just issued his advance 1914 catalogue, which is designated as No. 27, and with an edition of 100,000. The catalogue is issued primarily for distribution at the automobile shows of the country and consists of 128 pages, describing and illustrating hundreds of specialties and standard equipment, accessories and supplies for motor vehicles, motor yachts and aeroplanes. Miller claims to be the largest and the oldest house in the country dealing in such goods. As manufacturer, jobber, importer and exporter he carries a stock that is unequalled and quick service is specialized. The catalogue is admirably designed and printed. A copy will be of distinct value to any person interested in motoring, motor yachting or aviation. It will be sent at request to any address.

John F. Soby is secretary and sales manager of the branch of the Brockway Motor Truck Sales Company of Homer, N. Y., which has been established at 250 West 54th street, New York City.

INTERNAL GEAR DRIVEN AXLES.

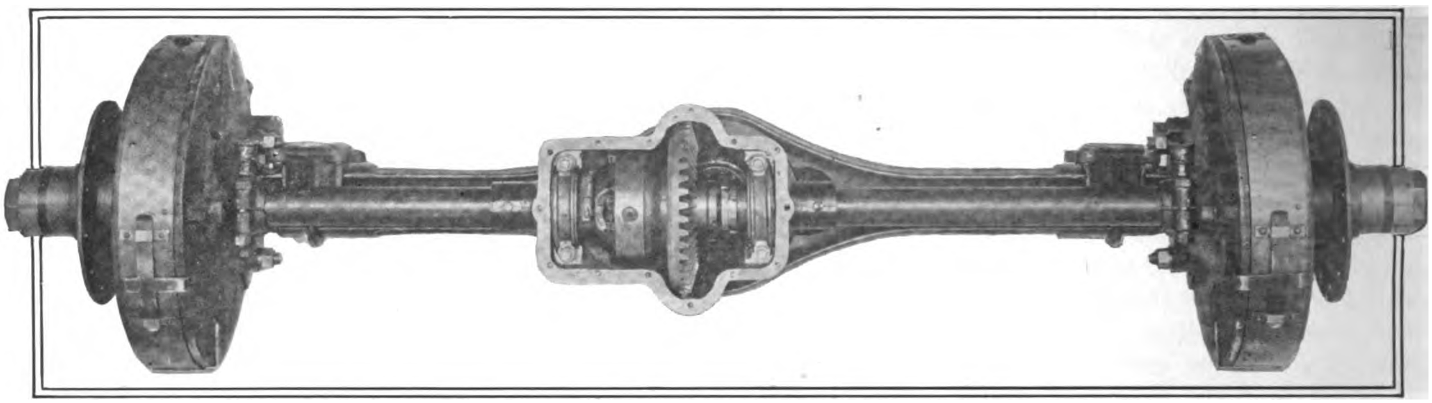
Torbensen Constructions Designed for Use with Gasoline and Electric Vehicles.

The Torbensen Gear & Axle Company, Newark, N. J., is now producing axles for service vehicles of the internal gear drive type, these being known as type R, for machines of 1500 pounds, and type S, for wagons of 3000 pounds capacity. The former size can be supplied with four different gear ratios, one of which is suited for electric vehicles, and the latter with three gear ratios. The principle of construction has been well established and the axles are maintained to be of high quality, affording extreme efficiency and having long endurance. The axles are identical save in that the parts of the type S are larger to meet the greater requirements of service.

The axle itself is an I section drop forged from selected steel, and the centre is made about double the width of the arms. At this section there is at either side a boss, through which is a circular eye or opening, and reinforcements for seating the bolts retaining the driving axle or jackshaft. At the ends of the axle are tongues which project above and below it to support the inner brake plate and the brake shafts. Outside of these tongues the axle is machined to cylindrical form. These ends are bored and reamed to a taper. The axle spindles are of chrome vanadium steel and are ground to the dimensions of the holes in the axle ends. The axles are then heated and when sufficiently expanded the spindles are forced into the holes, so that the metal, as it cools, holds the spindles so that they can only be removed by boring. The cylindrical portion of the axle extends into the wheel hub nearly to the centre line of the hub, so that the bending stress upon the axle is very small. The spindles are ample to resist all strains upon them. The spindles are fitted with either taper roller or ball bearings as may be desired by the manufacturers who are to use the axles.

On the back side of the axle is the jackshaft, which is housed in a central section divided vertically and bolted together, with shaft tubes extending from this section to fittings bolted to the axle carrying the outer bearings. On the forward side of the axle is bolted the housing that carries the bearings for the pinion shaft. The differential is mounted in the axle housing on either ball or roller bearings and the axle shafts carry pinions at the outer ends. The drive is by these pinions meshing with an internal ring gear that is a drop forging, and is pressed into the hub of the wheel, being secured by 12 rivets. These rivets serve as keys and lock the ring into the hub. Two overlapping shoulders protect the gear and pinion against dust and an annular ring laid in a groove in the inner running joint serves like a piston ring and retains the lubricant.

These axles are fitted with a service brake of the external type with bands contracting on pressed steel drums surrounding the internal gear, and internal cam expanding brake shoes operating within these drums for emergency. The type R axles are made with reductions of 5.25:1, 6:1, 6.8:1 and 11.3:1, the last named being generally used for electrics. The type S axles are supplied with reductions of 6.15:1, 7.20:1 and 8:1. These axles have been carefully designed and the principles have been established by use for years. The claim is made that the internal gear drive insures a very uniform application of power, and there is but little variation in power losses. The axle is constructed of high grade material and aside from renewal of lubrication from time to time it requires minimum attention.



The Torbensen Internal Gear Driven Rear Axle, Suited for Gasoline and Electric Vehicles, Made in Two Types and with Different Reduction Ratios, for 1500 and 3000-Pound Machines.

The Capitol Hill Truck Manufacturing Company has been formed at Denver, Col., to build electric service wagons. The president is Charles A. Scott, who has other interests in the automobile industry. The plans of the company are to build a factory in Speer boulevard that will have a capacity of perhaps 100 vehicles annually, and the purpose is to turn out at least 50 the coming year. The design that is now being considered is for a shaft drive machine with the battery in three sections, one in front under a hood and the other two carried on running boards at the side. The vehicle is not an uncertainty, several which embody the chief qualities sought having been built and used for considerable time in experimental service in the city of Denver.

AUSTRIA'S ELECTRIC POSTAL WAGONS.

An Installation in Vienna Which Comprises 30 Electro-Daimler 2.5-Ton Vehicles—Garage Facilities, Battery Care and Construction of the Machines.

ONE of the most interesting installations of electric vehicles abroad is that recently inaugurated by the Austrian Postoffice Department in Vienna. This is particularly true, because, for reasons which do not appear exactly clear in this country, foreign business men have not looked with favor upon the use of electrics. The official indorsement of the Austrian imperial government is expected to mean much to this branch of the industry in Continental Europe, and very probably in Great Britain, as well.

General View of the Garage Where Electro-Daimler Postal Wagons Are Housed in Vienna, Austria.

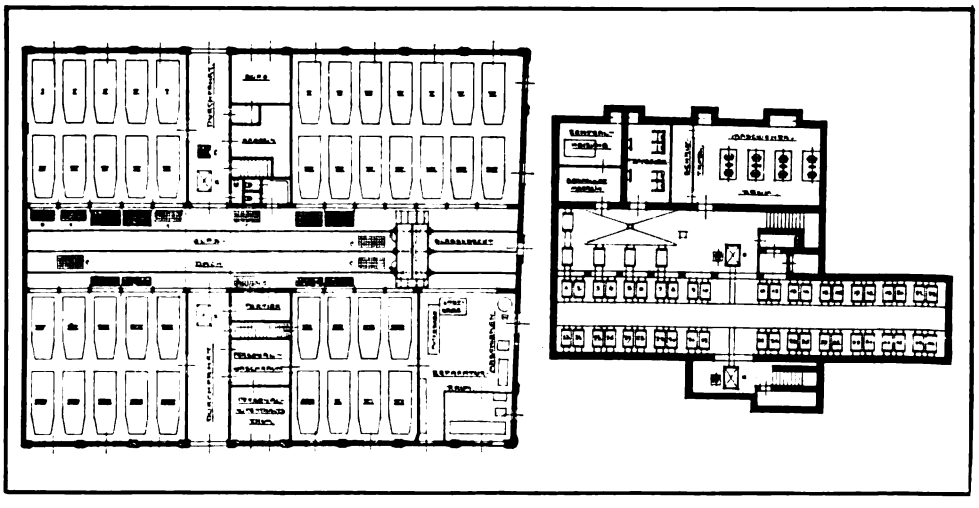
The installation comprises 30 Electro-Daimler wagons of practically 2.5 tons capacity, built by the Austrian Daimler Motoren-A. G., of Vienna, a concern which is much better known in America, at least, for its production of Austro-Daimler gasoline cars and trucks. The service was begun June 15 of this year, but not until experimentation covering a period of more than a year had demonstrated to the satisfaction of General Postmaster von Uhl that the electric was suitable in every respect.

It is not understood, as the result of correspondence with the maker of these cars, that they are owned by the government, inasmuch as the service is supplied by a private concern, the Austrian Daimler-Tudor Omnibus-Gesellschaft. This company has been operating electric omnibuses in Vienna for some two years, and it was from observation of these vehicles that the government officials first had their attention drawn to this type of transport.

Having decided to experiment with electrics, the imperial wagon works, Jacob Lohner & Co., Vienna, was commissioned to construct a special body design to meet the needs of the postoffice department, in the transportation of packages and mails, and this was fitted to an Electro-Daimler chassis. This machine was delivered to the government March 1, 1912, and was at once placed under the charge of the omnibus company. During the year this was driven 17,000 kilometers (about 10,000 miles), and careful observation was made relative to its economy and efficiency. At the conclusion of this experimental period, the omnibus company made public the following statement:

> General Postmaster von Uhl considered both types of vehicle and found that the electric possessed the advantages of safety, cleanliness, simplicity, noiselessness and of being odorless. It was also found that the cost for power was 20 per cent. less. The decision was made easily.
>
> In Europe, it has been felt that, on account of the disadvantages of the battery, electric power was not practicable for trucks, omnibuses, etc., while in America the use of specially heavy electric trucks has increased rapidly. With the constant advance in the price of gasoline, the electric will be used more and more, especially by such enterprises as this, where the installation is large. This year, this type of vehicle is gaining ground all over Europe, as is true in America. It is a mistaken idea that the battery gives trouble, as is borne out by a service of 15 months on a given line in Austria, covering 500,000 kilometers without interruption.

The postoffice machines in question are housed in a special garage, work on which was begun Oct. 29,



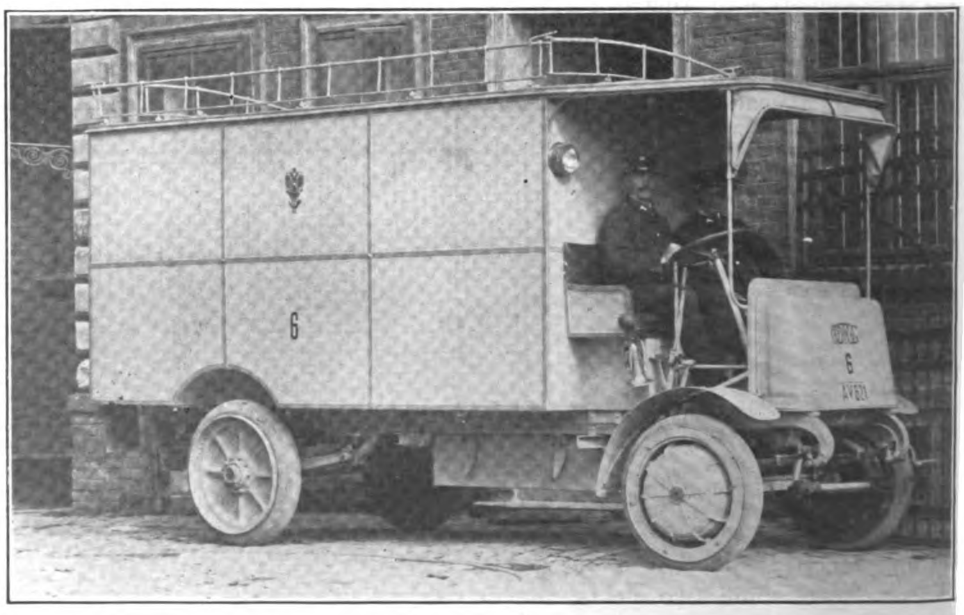
Plan View of Postoffice Department's Garage in Vienna, Showing Arangement of Stalls on the Main Floor at Left, and Location of Battery Room, Etc., in Basement at Right.

Front View of Electro-Daimler Postal Wagon, Indicating Construction of Forward Axle, Etc.

1912, and finished in May of this year. The building is located with a frontage on three streets and is 40 by 31 meters (131 by 102 feet). It consists of one story and basement, the cars being stored on the main floor, and the battery room being in the basement. The building was erected to accommodate 45 machines, although but 30 have been installed as yet.

An accompanying diagram indicates the interior arrangement. It will be seen that the machines are assigned to stalls on either side of a main driveway through the building, and the government demands 10 square meters for each. Cars are not turned around in the garage under their own power, but are driven upon a turntable, and this turntable is mounted on rails in such a manner as to permit its being used on any portion of the main driveway.

Whenever it becomes necessary to change a battery, the car is shunted into an aisle branching off at right angles to the main driveway, at either side, and is located over an opening into the basement. An elevator, bearing a platform, is hoisted through this opening until the top of the platform bears against the bottom of the chassis. The battery is carried on the chassis in such manner, being supported by bars, as will be explained in more detail later, that a simple movement of these bars frees the crate and lowers it to the platform. The elevator then disappears into the basement and a fully charged battery is hoisted into place. The whole operation consumes between one and two minutes.



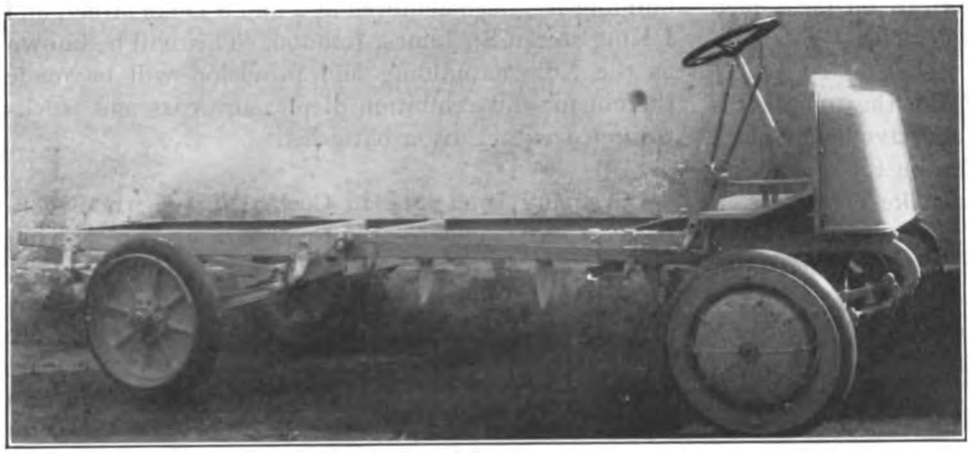
One of the Electro-Daimler Postal Wagons Which Are Utilized by the General Postmaster at Vienna, Austria.

There were two good reasons for this arrangement of floor space, the first being that of segregating the battery work and providing for a quick exchange of batteries, and the other, the necessity for economizing on space so as to provide for a power room, stock room, office and a large tool room and repair shop.

The power room is located in the basement. Current is delivered to the garage from the city electric works and at a voltage of 5000. This is transformed to 220 volts, alternating current. This is again transformed to 110 volts, direct current, for charging purposes, in a special room equipped with the very latest electrical appliances for this work.

The chassis, which are the product of the Austrian Daimler Motoren-A. G., are distinctive, in that the motors are located in the front wheels, a type of construction which is not entirely new in American practise, however. The frame is of pressed alloy steel, and this is mounted on extra long springs designed to possess easy riding qualities. The axles are of chrome steel, and the rear wheels of pressed steel, mounted on ball bearings. There are two sets of brakes, in addition to the electric brake which operates on the front wheels, and both of these act direct on rear wheel drums. Tires are solid rubber, 850 by 140 mm front and 900 by 160 mm rear. The wheelbase is 3300 mm (130 inches).

The motors in the front wheels are with the pole pieces arranged in the form of a star, while the armature is attached to the case forming one side of the wheel, supported on either side by ball bearings, and the assembly is so bolted together as provide practically a unit construction. The armature is wound in the conventional manner, and the collector brushes are so positioned that the vertical vibrations of the car cannot injure them. The brush bridge is of the ring design, located on the forward part of the axle.



Stripped Chassis of the Electro-Daimler Postal Wagon, Indicating the General Constructional Features.

ing through a neat application of the worm and worm wheel principle. Steering is accomplished by a hand wheel of the conventional type.

The bodies are of special design, conforming to the specifications supplied by the postoffice officials, and are the product of the imperial wagon works, Jacob Lohner & Co. They are entirely enclosed, with entrance from the rear, and may be locked so that the driver and attendant may not reach the contents. Inside is a special compartment for valuable packages, this box being lined with zinc. Provision is made on top for carrying extra large packages, a wire fence preventing dislodgement. This fence is made so that it may be turned down, on account of the entrances to several of the postal stations, the machines being driven directly into the buildings and the contents being handled by government officials alone.

As the service is furnished by a private corporation, each vehicle is fitted with a speedometer, payment being made for each kilometer travelled. The wagons have a guaranteed radius of 35 kilometers (21.7 miles). The tires also are supplied on a guaranteed service basis.

The construction is such that by removing the outer safety casing or cover, the collector with its brushes is fully exposed and accessible. The motors are dust and water tight, and easily dismounted. They are of the high speed type, 90-volt, with maximum of 15 horsepower.

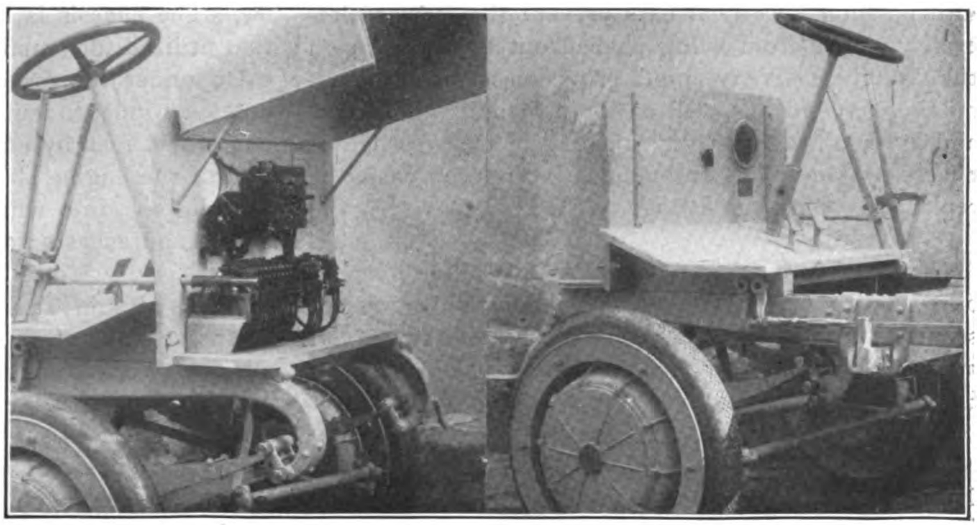
The battery is carried in a tray in the centre of the chassis at the front, as indicated in an accompanying illustration. The method of fastening is extremely simple, two bars, or parallel rails, one at the front and the other at the rear, as shown, being inserted in clamps provided for that purpose. With the platform on the elevator pressing against the bottom of the tray, as explained above, the weight is taken from these bars and it is an easy matter to withdraw them, when the battery tray is immediately released from the chassis.

The batteries are each 42 cells, type VI Ky 285/4, and are rated at 300 ampere-hours, with five hours discharge rate, and with maximum capacity of 60 amperes. Their weight is 870 kilogrammes (1918 pounds). In order that there shall be no opportunity for delay in the service the company maintains 56 of these, so that it practically is possible to have one battery in reserve for each truck at all times.

All electrical apparatus—controller, switch, meters and coil—is carried at the front of the dash, where it is protected from dirt and dust by a short hood. This is readily accessible by lifting the cover, which is hinged at the top and provided with rods to hold it in an upright position. The controller gives three speeds forward and one in reverse, and operates the electric brake on the front wheels. The driver is at the right, with two levers also at the right. One of these actuates the emergency brake on the rear wheels and the other the controller, the latter work-

GENERAL NEWS FROM ABROAD.

Another Electric Truck Maker—As a result of the favorable impression made upon B. M. Drake of Drake & Gorham, Ltd., London, England, during his recent visit to the United States, this concern, which is well known in Great Britain as a firm of electrical engineers, is working on plans for an electric truck, which will be placed on the British market in the near future. Mr. Drake says he was particularly interested



Details of Electric-Daimler Construction: At Left, Location of Controller and Electrical Apparatus, Showing Worm Drive Employed; at Right, Front Wheel Casing Enclosing Electric Motor, Etc.

in the figures obtained from American business men regarding the economy of electric vehicles.

Motor Trucks in Ireland—While the merchants and business men in Dublin, Ireland, have been studying the subject of motor transportation for some little time, it is stated that the recent strike of carters in that city has had the usual effect abroad. Many concerns, who were compelled to adopt some means of securing immediate delivery, decided at once in favor of motor trucks, and the success of the plan has been so marked that orders for from five to eight vehicles have been received by makers in several instances.

Trucks at Paris Salon—Because of the many conflicting plans attendant upon the proposed showing of commercial motor vehicles in connection with the annual Paris Salon, only 21 different makes were placed on display. At the last moment the government decided to permit the erection of a temporary structure in the Cours la Reine, adjoining the Grand Palais, and it was in this that the vehicles were shown. The exhibition was particularly interesting from the fact that steam machines were featured much more extensively than heretofore. This type of vehicle has not received decided encouragement in France, although it has been utilized with a large measure of success in England, and Germany and some other Continental countries. Another feature of the exhibit was the number of dumping wagons on display. As might be expected, a majority of the chassis shown were of the subsidized types.

Saurer Ambulance for Russian Army—Adolph Saurer of Switzerland has just made delivery of a Saurer ambulance to the Russian military officials, which discloses some interesting innovations in the body arrangement. The interior provides space for six stretchers, three on a side, suspended by coil springs, also for two seats, which are intended either for attendants or for wounded able to sit. A system of pulleys serves to hoist the two topmost stretchers into position. Vertical bars prevent the forward lateral windows from being pushed out by the men on the stretchers. Very ample provision is made for admitting daylight, as well as for protecting the driver and attendant against inclemencies of the weather. If necessary, the whole ambulance fixtures can easily be replaced by omnibus fittings.

Wants South African Agency—A. Collins, Maritzburg, South Africa, announces that he is desirous of securing an agency for a reputed make of commercial motor vehicle and for any good brand of solid tires. He invites correspondence direct.

Edison Batteries in England—The increase in the demand for Edison batteries in Great Britain has been such that it has been found necessary to secure additional room for Edison Accumulators, Ltd., and a new building has been acquired at 2 and 3 Duke street, and 1 King street, St. James, London. This will be known as the Edison building and provision will be made therein for the exhibition of pleasure cars and trucks equipped with Edison batteries.

Germany Interested in Costa Rica—German consular reports indicate that there is a certain demand for interurban motor 'bus lines in Costa Rica, and German manufacturers are urged to cultivate this market. It is explained that the cross country roads are not suitable for automobile use, but within the past year some 18 motor cabs have been installed in San Jose with satisfactory results.

Japanese Government Interested—It is reported from Tokio, Japan, that the war office has decided to purchase a number of military motor vehicles. Not only will a motor wagon corps be formed for transporting provisions, etc., and the officers, but also a flying corps and a wireless telegraphy fleet of automobiles, provision for which will be made in the budget for next year.

Demand in Straits Settlements—The registrar of imports and exports at Singapore reports that the estimates of expenditures for 1914, for the Straits Settlements, include provision for a motor truck and four dumping wagons at a total cost of $40,000. The demand for all types of motor vehicles in this section is growing rapidly.

Experiment with Electric Ambulance—The Metropolitan Asylums Board, London, England, has decided to experiment with electric driven ambulances. Two chassis have been purchased from the Cedes Electric Traction Company, Ltd., the purchase price being about $1950, exclusive of the body and batteries.

Schneider Water Filter Plant—The French military authorities have been investigating the possibilities of an automobile water filter plant for army service. The chassis is a standard Schneider, similar to that utilized for omnibuses in Paris. The motor is located under the driver's feet, and for filtration purposes, an independent pump carried on a two-wheeled bogey is driven by an electric dynamo on a continuation of the engine shaft. Two tanks are united by a flexible pipe, into which the water is filtered through cotton and asbestos discs.

Paris Would Tax Trucks—The prefect of the department of the Seine, Paris, France, has asked permission to impose a tax on commercial motor vehicles, based upon the weight of the car and the horsepower rating. The fees suggested include $60 a year for 25 horsepower vehicles weighing 3.5 tons, and $200 for a 50 horsepower machine weighing eight tons, if shod with rubber tires, or $300 with steel tires. Other proposed rates are in proportion to those selected.

Municipal Service Equipment

FEDERAL FIRE WAGON.

A New Body Design Which Has Met with Decided Favor During the Past Season.

The Federal Motor Truck Company, Detroit, is directing special attention at this time to its combination chemical engine and hose wagon, a body design that is fitted to the regulation Federal truck chassis. The first vehicles of this type were produced by this company about a year ago, and the popularity which has resulted from the original installations has been such as to win a large measure of success for the company in this field and the demand is increasing very rapidly in many sections.

The capacity of the chassis is one ton, and the wheelbase is 144 inches. The engine is rated at 30 horsepower and the maximum speed of the wagon is placed at 22 miles an hour. Control is at the left side.

Federal One-Ton Chassis Equipped as a Combination Chemical Engine and Hose Wagon.

Brass clutch rails extend the full length of the body to the rear stepboard, on which are two spindles for hose nozzles. The equipment includes: One thousand feet of standard fire hose, 35-gallon chemical tank with connection for hose from the hydrant, two five-gallon hand extinguishers in brass receptacles, hose basket suspended over the front of the body with capacity of 250 feet of chemical hose, two 20 to 25-foot extension ladders, poles, hooks and many other implements necessary for fire fighting.

WANTS MOTOR APPARATUS.

Jersey City Commissioner of Public Safety Says Present Equipment Is Antiquated.

Frank Hague, commissioner of public safety in Jersey City, N. J., has asked the city commission to permit him to expend $168,525 for new equipment and to appoint extra men. Concerning the acquisition of motor apparatus, he has the following to say:

Many of the engines now in service are antiquated. These must be replaced sooner or later by modern apparatus. A motor driven aerial truck to replace hook and ladder No. 6, that has outlived its usefulness, would work wonders. Such an apparatus is absolutely necessary and should be acquired at once. It could be pressed into service on second and third alarms in any section of the city.

There is not a single spare or reserve engine in the department. This is a serious condition, as, if an engine is disabled when in service, there is none to take its place. In all well regulated fire departments a contingency of this kind is provided for. This should be the case in this city, and I am firmly convinced that if two motor driven engines were put in service every emergency would be met. Results accomplished would more than pay for the money expended.

NO HORSES DOWN TOWN.

Tacoma, Wash., Witnessed an Important Event in Its History Last Month.

For the first time in the history of Tacoma, Wash., the fire department responded to an alarm of fire in the down town district last month without a horse drawn vehicle. Every piece of apparatus that answered the call from the Realty building on this instance was gasoline propelled. In commenting upon the incident Chief George McAlevy voiced his regret concerning the passing of the horse, although he appreciates the value of the newer equipment.

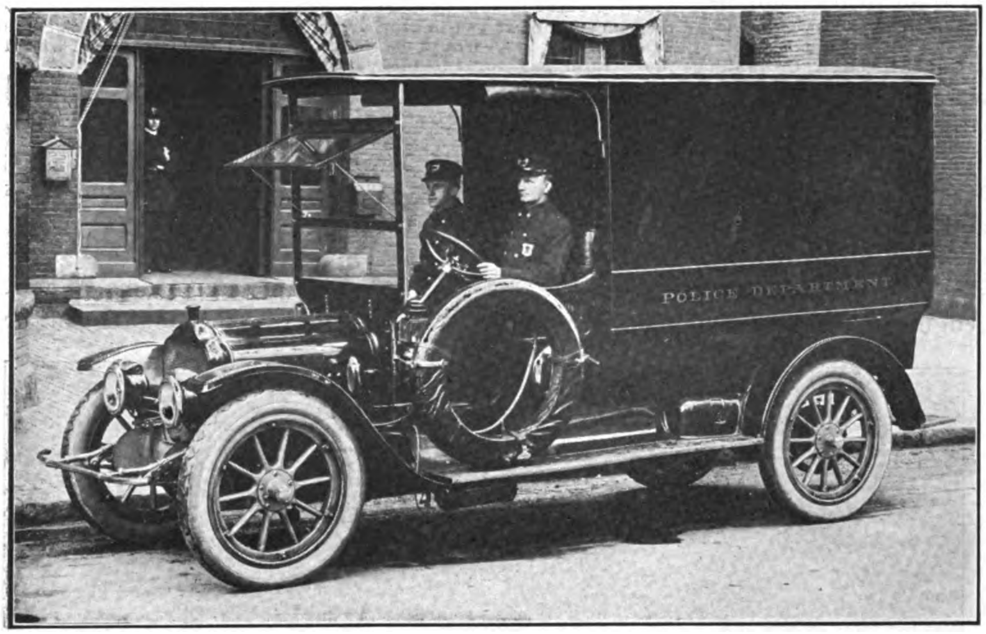
"While the good old horse has not been entirely eliminated from the fire department in this city", said he, "he will never again answer the calls in the down town district". Some of the stations in the outside sections still have horse drawn wagons, but it will only be a question of time when these will be replaced with automobile equipment. "It may be that old Dobbin will receive a call once in a while, in cases of emergency, but I doubt it", concluded Chief McAlevy

WHITE PATROLS IN SERVICE.

Stability and Efficiency of Worcester Equipment Is Satisfactorily Demonstrated.

In October, 1911, the police department in Worcester, Mass., placed in service one combination patrol wagon and ambulance and a vehicle equipped exclusively for ambulance work. About a month later another combination machine was added. All three chassis were of White make, produced by the White Company, Cleveland, O. The stability and efficiency of these three machines has been so well demonstrated during the past two years that a fourth has now been purchased and will be installed shortly.

During the two years which the three machines have been in service they have answered an aggregate of 18,728 calls, and have covered 43,455 miles. As ambulances the wagons are expected to go anywhere, and several instances are on record in which they have been called upon to traverse places that an ordinary motor car driver would consider impossible. Trips have been made through fields and wood lots, and often the way has been strewn with rocks or the mud has been hub deep.



White Combination Patrol Wagon and Ambulance, Which Has Seen Two Years' Service with Department in Worcester, Mass.

All three machines have been in constant service, with the exception of two or three days, when overhaul work has been deemed advisable. Each is in good running condition, Chief Mathews being of the opinion that they are practically as serviceable in every way as when they left the factory. The expense for repairs has been so small as to be almost negligible.

Aside from the economy afforded, as compared with horse equipment, the people of Worcester have had many examples of the value of the ambulance feature, in the numerous quick runs which have resulted in the saving of human life. This has been particularly true in cases of asphyxiation and drowning, where the pulmotor has been rushed to the scene. There also are hundreds of instances in which people have been wounded and have been saved from serious results through the ability of the police department to make rapid time in reaching the hospital or medical attention. Surgeons in charge of these patients state that many of them would have died had they been compelled to wait for a horse drawn ambulance.

ECONOMY OF MOTOR PUMP.

Experience of Pasadena Department Shows Decided Saving Over Steam Engine.

The use of motor pumping engines in the fire department has been a subject of much inquiry and investigation by fire chiefs throughout the country. It is not often that it is possible to give dependable figures as to the maintenance cost of this type of apparatus, covering a period sufficient to permit of satisfactory comparison with horse drawn steam pumping engines.

The department in Pasadena, Cal., has an automobile of this type at the station on Mentor avenue, and a steamer drawn by three horses at the house on Dayton street. The former has been in service one year, and the two have been so situated as to answer about the same number of alarms and to cover approximately the same mileage.

In his annual report Chief Arthur M. Clifford states that the maintenance cost for the gasoline pumping engine for the year was $51.40, in answering 43 alarms and travelling 61 miles. The expense for the steamer drawn by three horses was $685.32, and it answered 45 alarms, covering 63 miles. The difference is $633.92.

In commenting upon this showing Chief Clifford calls attention to the fact that the saving would not be as marked between the Mentor avenue apparatus and other horse drawn equipment in the city, for the reason that with most wagons only two horses are employed.

INVESTIGATION IN PITTSBURG.

Report Recommends Motorization of Fire Department After Tests Have Been Made.

At the request of the city council in Pittsburg, Penn., two bureaus of municipal research and efficiency engineers have investigated the fire department in that city with the purpose of recommending

such changes in management and equipment as would seem desirable. One of the investigators lays great stress upon the matter of motorization, and makes the following recommendations:

That accurate tests and records as to motor equipment be carried out and maintained.
That these tests and records establish the type of motive power to be purchased.
That the council withhold the $120,000 for new motorized apparatus until this is definitely established.
That motorization be undertaken first in the outlying districts.
That automatic decrease in the size of the bureau be allowed to eliminate the 139 men not required.
That motorization be pursued with a speed that will permit the reduction to be made according to the natural elimination of the members of the bureau.

NEWS FROM VARIOUS CITIES.

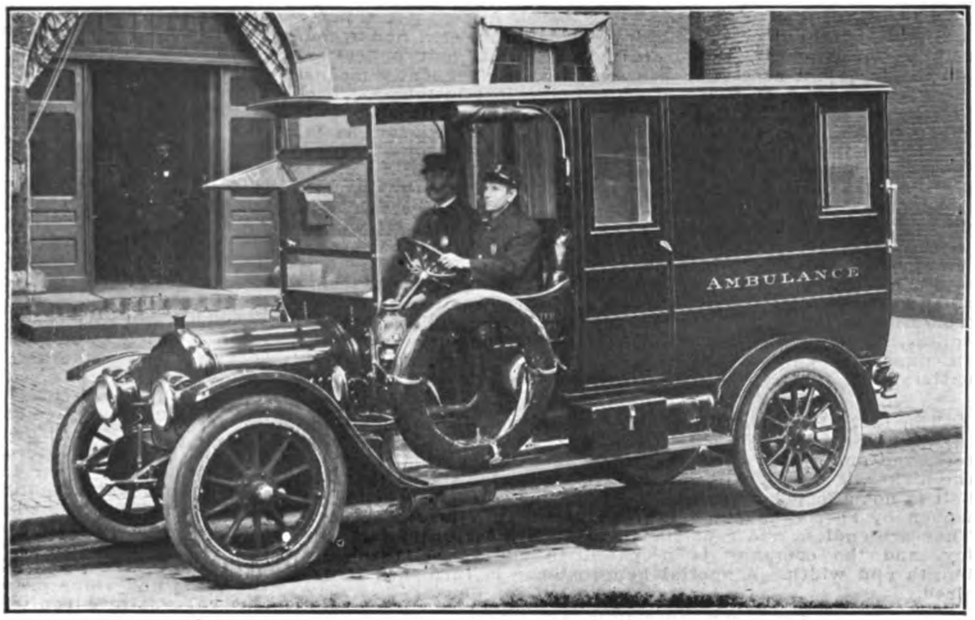
In the Market—The following cities are considering the purchase of motor driven fire apparatus: Suffolk, Va.; Livingston, Mont.; New Haven, Conn., pumping engine; Kearny, N. J., fire engine; St. Augustine, Fla.; Rochester, N. Y., two combination chemical and hose wagons; Providence, R. I., two combination hose and chemical wagons; Douglas, Ariz.; Oklahoma City, Okla., pumping engine; Manitowoc, Wis.; Chico, Cal., hose car; Hot Springs, Ark., chemical and hose car; Ottawa, Ill.; Vallejo, Cal., combination chemical and hose car; Chicaga, Ill., two combination chemical and hose cars; Corsicana, Tex., combination chemical and hose car; Oxnard, Cal.; Lestershire, N. Y.; Reading, Penn.; Carthage, Mo., one piece; Merchantville, N. J.

Motors in Grand Rapids—When motor fire equipment is being considered by other cities, Grand Rapids, Mich., has a high position among cities of its size. There are now 10 pieces of this apparatus in use by the department, including five hose wagons, two chemical trucks, two tractors, four ladder trucks and a tractor for a steamer. In addition there are now being constructed a tractor for a ladder truck and an aerial ladder to be drawn by a tractor. Besides the apparatus there are a number of automobiles for the use of the officials of the department.

Cleveland's Apparatus in Snow—The recent heavy snowstorm at Cleveland, O., brought out forcibly the superiority of the motor driven fire apparatus over the horse drawn vehicles. On account of the bad traffic conditions during the storm orders were given that none of the heavy horse drawn hook and ladder trucks, steamers and hose wagons should leave their respective houses. At one of the houses a Peerless tractor had been installed to haul a 65-foot ladder truck, and when a fire alarm came in at the height of the storm this tractor, drawing the six-ton ladder truck and a crew of 13 men, weighing more than another ton, made the trip successfully.

Hartford's Police Patrols—After being entirely overhauled and rebuilt the police patrol automobile of Hartford, Conn., has been returned to the service. The police department of that city is now equipped with two patrol automobiles and an automobile ambulance, all three of which have demonstrated the highest type of efficiency.

KisselKar Wagon for Fall River—A KisselKar hose and chemical wagon has just been delivered to the fire department of Fall River, Mass., which has won the unanimous approval of Chief Davol and the board of fire commissioners after its official test. The apparatus is mounted on a six-cylinder chassis of 60 horsepower and is the third piece of motor equipment purchased by this city.



White Ambulance in Service with Worcester Police Department at Headquarters.

Installations of Apparatus—Motor driven fire apparatus has recently been installed in the service of the following cities: Reading, Mass., triple combination truck; Amesbury, Mass., combination hose and twin tank chemical; Springfield, Mass., electrically operated Seagrave ladder truck; Thompsonville, Conn., hook and ladder truck; Holyoke, Mass., two tractors and two combination hose and chemical wagons; Roselle, N. J., combination pumping engine; Sandusky, O., triple combination pump, chemical and hose car; Pasadena, Cal., two combination chemical and hose cars and a 75-foot aerial truck; Red Bank, N. J., two piston pumping engines; Des Moines, Ia., Dayton airless tires for the motor apparatus.

New Commercial Car Accessories

Volcano Electric Primer.

The Volcano electric primer differs from the usual priming devices in that the vaporization of the fuel is obtained by the heat of electricity. A plate device is fitted inside of the intake manifold of the motor and gasoline is led to it by tubing. The capacity of the intake member is proportioned to make an inflammable mixture. A small dash vessel contains the priming fluid and a control member is also provided. Current is supplied by a six-volt storage battery or dry cells. The maker states that the dash container has sufficient capacity to provide about 150 starts when the motor is cold.

Motophone Horn.

The Automobile Supply Manufacturing Company, 220 Taaffe Place, Brooklyn, N. Y., is introducing a new horn known as the Motophone. It is mechanically operated, a slight pressure on a conveniently located lever resulting in a loud, steady, pleasant sound. The operating mechanism has been perfected by the maker after long experimentation and it is stated that the tests to which it was subjected were unusually severe. The maker calls attention to the convenience of the signal, in that its operation does not depend upon batteries. Throughout the workmanship and material are high class.

J & B Magnetic Lift.

In the overhaul of the motor, transmission, etc., and when making adjustments, the dropping of a nut, bolt or cotter pin in places not accessible with the fingers, frequently means the disassembling of parts to recover the lost members. The J & B Manufacturing Company, Pittsfield, Mass., has brought out a useful, as well as practical, tool for recovering parts dropped in the pan or mechanism of the car. It comprises an electromagnet in sections, having a handle containing a switch for opening and closing the circuit between the device and the battery. These sections are so constructed as to carry the current from the handle to the magnet end without wires, and as the electromagnet is always at the end of the tool, maximum lifting power is provided at the service end. The device is designed for the owner, repairman and service station, and the maker states that it has sufficient power to lift valves from the cylinder heads. The tool weighs complete but 12 ounces, has a lifting power of 12 pounds, consumes but half an ampere of current and may be utilized with any six-volt battery.

Curry Fan Belt.

The C. & B. Hinson Company, Cincinnati, O., is manufacturing a fan belt designed particularly for model T Ford motors, and one of the qualities of the material, as indicated by the maker, is that it will not stretch. It is also stated that the belt is not affected by grease, oils, dirt or heat. The belts are woven by special machinery and treated by a secret process. They are endless and constructed to fit any design of fan pulley, and the company is prepared to supply belts in any length and width. A special belt fastener is furnished if desired.

Ten Eyck Automatic Air Pump.

The Ten Eyck automatic air pump is manufactured by the Ten Eyck Pump Company, Auburn, N. Y., and may be employed for inflating tires or in connection with a compressed air type of motor starter. The gearshift is automatically controlled by a separate piston and cylinder, which is operated by the pressure in the tank or tire. The back pressure from the air receiver slides the pump gear into mesh with the driving gear, the pump gear running idle until the two gears are partly meshed. The clutch is then engaged. Disconnecting the pump from the air receiver allows the pressure to escape from the automatic cylinder and the gears are disengaged by means of a spring. In this operation the clutch is first disengaged, permitting the pump gear to run idle while being drawn out of mesh. This arrangement makes easy engagement and disengagement of the gears without reducing the motor speed. All parts are constructed of high grade material and the workmanship is first class. The pump is 10 by 4.5 inches, weighs 10 pounds and has a capacity of two cubic feet a minute.

V Hot Air Valve.

The use of heated air in carburetion is becoming more general and the usual method is to convey the warm air from proximity of the exhaust manifold to the air intake of the carburetor by means of a flexible tube. A different application of the principle is noted in the V hot air valve marketed by V Air Valve & Manufacturing Company, 1648 Tremont street, Denver, Col. It comprises a hood like member, which is clamped on to the exhaust pipe or manifold; flexible metallic tubing for conveying the heated air, and the V valve. The last named member is screwed into the intake manifold above the carburetor and control of the valve is by a wire cable operated by a lever clamped to the steering column under the wheel. This permits the driver to regulate the amount of air admitted according to atmospheric conditions, etc., also to utilize the control for flushing out the cylinders with fresh air, as in coasting down hill, for example. The maker states that considerable more mileage is obtained to a gallon and that further economy results, in that at high piston speeds the emergence of the fuel from the jet is restricted without affecting the output of the motor.

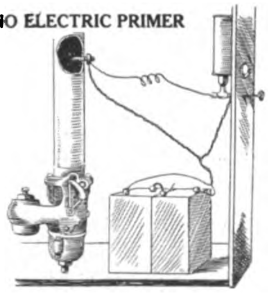
Auto-Queen Wrench Set.

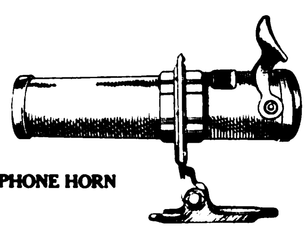
The Auto-Queen wrench set is produced by the C. M. B. Wrench Company, Garwood, N. J. The No. 11 set includes a ratchet wrench, universal joint, long extension, spark plug socket and 15 sockets. The last named members provide for a number of different sized nuts and bolts, both square and hexagonal. The outfit comes in a neat, substantial hard wood box and weighs seven pounds.

Breeze Tank Valve.

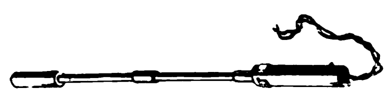
The Breeze Carburetor Company, Newark, N. J., is marketing the Breeze 4-in-1 tank valve, which obtains the reserve capacity of fuel without the auxiliary tank being in the fuel container. Two outlet levels are utilized in the tank, the service member being slightly higher than the reserve, and according to requirements. Two controls are provided, one for each outlet, also two "off" positions, connection between the indicating plate and valve proper being made by a rod arrangement. The valve is provided with a gauze strainer, also a screw plug member for cleaning and draining. One of the features of the valve is that it may be locked, preventing use of the car by others than those intended.

VOLCANO ELECTRIC PRIMER

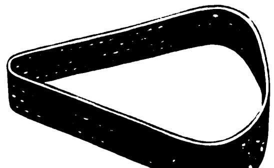




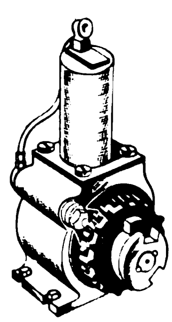
MOTOPHONE HORN



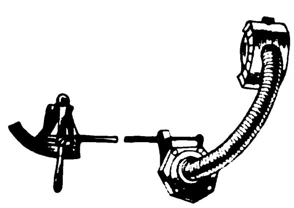
J & B MAGNETIC LIFT



CURRY FAN BELT



TEN EYCK AUTOMATIC AIR PUMP



V HOT AIR VALVE

AUTO-QUEEN WRENCH SET

Some of the More Recent Accessories Adaptable to the Commercial Vehicle, Repair Shop and Service Station.

THE A B C OF MOTOR TRUCK IGNITION.

Part XVI—Characteristics of Mea True High-Tension Magneto, Employing Bell Shaped Magnets Placed Horizontally and in the Same Axis with the Armature—Independent and Dual Equipments.

By C. P. Shattuck.

PREVIOUS discussions of magnetos dealt with those conventional forms utilizing a breaker box or interrupter mechanism which permitted the driver to control the break or interruption of the primary current, or, in other words, to advance or retard the spark. This has been designated as variable advance, a construction making for motor efficiency if handled intelligently by the operator. It has been pointed out that the greatest efficiency is obtained from the magneto when the greatest number of lines of force are cut and that the quality of the spark, its heat value, is dependent largely upon the position of the armature with reference to the magnetic field, or the relation of the armature and field, when the spark is created.

With the high-tension magneto the correct relation of position is established twice each revolution of the armature, or at intervals of 180 degrees, and two sparks may be obtained each time the armature is revolved once. The timing of the spark, as previously explained, is by causing the breaker or contact points to separate earlier or later, and if the magnetic field cannot be moved the relation between the armature and the field must be changed if the spark be advanced or retarded.

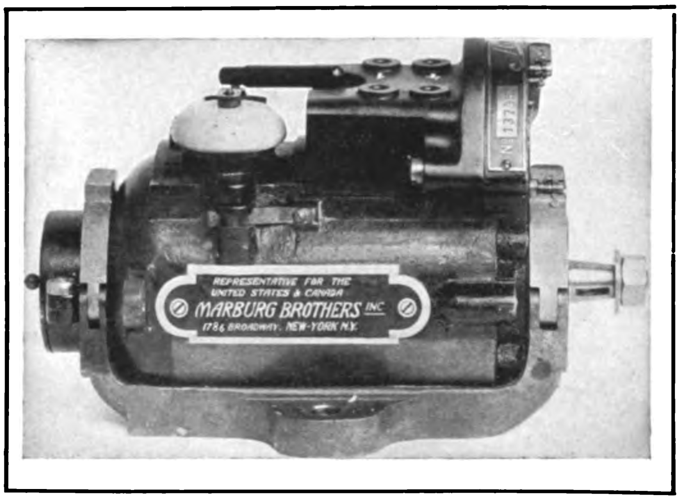


Fig. 85—Mea True High-Tension Magneto, Productive of Uniform Spark in All Positions of Timing as Breaker Is Attached to the Magnet, and Is Advanced and Retarded Simultaneously with It.

How Mea Differs.

The Mea magneto, marketed by Marburg Bros., Inc., 1790 Broadway, New York City, several types of which are illustrated herewith, is distinct from the designs discussed, in several particulars. The most noticeable feature of the construction is the use of bell shaped magnets instead of the permanent horseshoe type, and these are placed horizontally and in the same axis with the armature, instead of at right angle to it as with conventional designs.

The maker points out that this makes possible and practicable the simultaneous advance and retard of the magnets and breaker, instead of the latter alone, insuring maximum efficiency or heat value from the spark irrespective of the timing. This is due to established retarded positions between the magnet and the armature field.

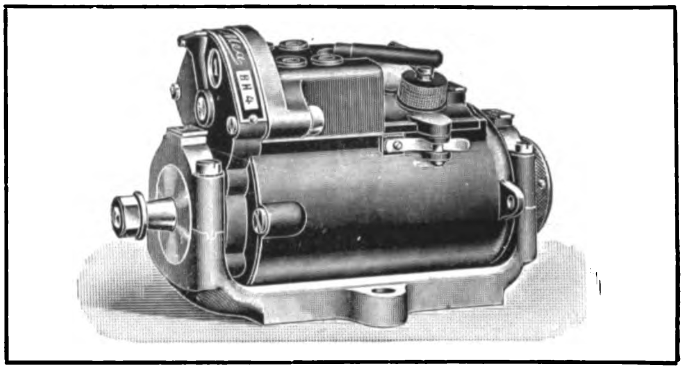


Fig. 86—The Mea Magneto, Type BH4.

Fig. 89 shows how Mea magnetic fields advance and retard. The range of timing of the Mea magneto is from 45 to 70 degrees, depending upon the size and type of instrument. The timing range, however, can be increased to any number of degrees desired. In other words, the relations are not changed and there should be the same value of spark at all times.

Value of Hot Spark.

The value of the equally hot spark in all positions of timing is well understood. The magneto can be put at full retard and the engine started easily if there is an explosive mixture in the cylinders. The maker further states that the magneto may be set as far ad-

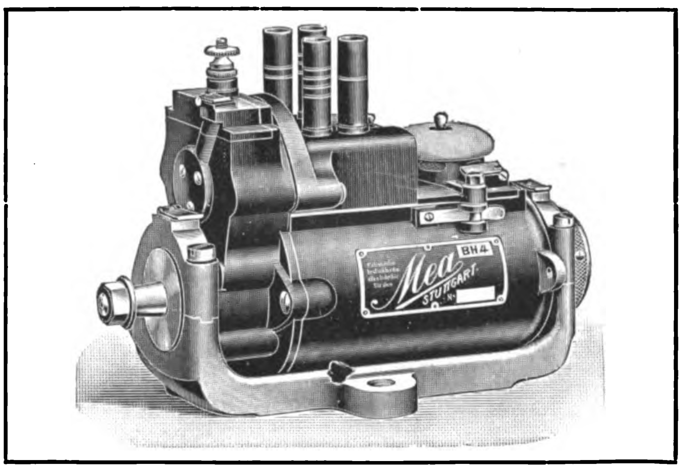


Fig. 87—BH4 Dual Mea Magneto.

vanced as the motor will ever require at the highest speed, and that notwithstanding this fact a retarded spark will be furnished which will permit of operating

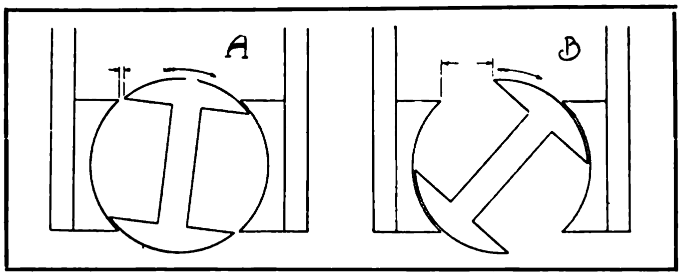


Fig. 88—Horseshoe Type Magneto: Relative Position of Magnets and Armature at Moment of Sparking in Advance Position (A), and Retard Position (B).

the engine at the lowest speed at which an explosive mixture can be drawn into the cylinders. Safety in starting is also emphasized. With the magneto timed to allow the highest motor speed, the spark can be retarded to a safe position for cranking. Another advantage claimed in the design is that the magneto will supply an intense spark when the motor is overloaded, as in hill climbing.

Mea Dual Equipment.

The Mea magneto is made to meet the requirements of different motors, including single and multiple-cylinder units, and a dual instrument is also marketed. The last named equipment comprises, in addition to the magneto, a Mea coil and switch, and differs from the standard design in that it is provided with a device for interrupting or breaking the battery or primary current.

A longitudinal section of the four-cylinder Mea magneto is shown at Fig. 92 B, the sketches A and C depicting the driving and breaker end respectively. It will be noted that the bell shaped magnet, with the poles in a horizontal line near the driven end of the magneto, partly encloses the armature, which rotates in ball bearings. The armature consists of a spindle or shaft carrying an I shaped iron core, which is wound with a heavy primary winding of few turns and a light secondary winding of many turns of wire. This armature shaft also carries the condenser, the collector ring and the low-tension breaker.

The circuit breaker is composed of a disc which carries a short platinum point contact and an insulated

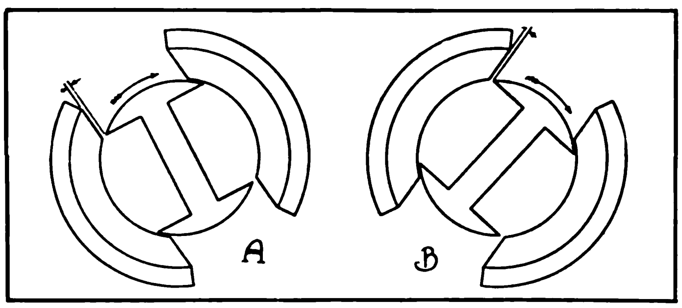


Fig. 89—Mea Magneto (Bell Shaped Magnet Type): Relative Position of Magnets and Armature at the Moment of Sparking in Advance Position (A), and in Retard Position (B).

plate which holds a spring supporting the other platinum contact point. This platinum point is adjustable. The circuit breaker or interrupter is operated by a fiber roller in connection with a cam disc, which is provided with two cams and is located within the breaker. The circuit breaker is parallel to the primary winding outside of the case, and is covered with a brass case or housing. In revolving with the armature the roller presses against the spring supported part of the breaker whenever it rolls over the two cams and in this manner opens the breaker, separating the platinum contact points twice every revolution of the armature.

Circuit Breaker Box.

The circuit breaker box is closed by a cover, which supports in its centre a carbon holder, by which the carbon member is pressed against the screw. The last named member connects at one end with the low-tension winding of the armature and at the other end with the core of the armature. The entire circuit breaker can be removed by displacing the screw referred to. The condenser is in parallel circuit with the circuit breaker and is fitted to the right armature cap. This serves to absorb the excess current induced by the breaking of the primary current.

The ends of the primary and secondary windings are metallically connected with the armature core and

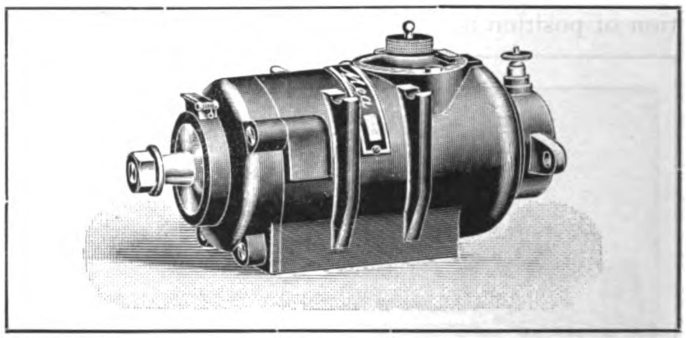


Fig. 90—The Mea Magneto Type A1.

consequently with the body of the magneto. The joint of the two wires is connected with a metal piece of the condenser, which is insulated from the armature shaft. The secondary wire is connected with a slip ring that is fitted to a vulcanite member, which is also insulated from the armature shaft. From this slip ring the high-tension current is conveyed through a carbon cylinder, carried by a holder and insulated from the cover, and thence to the distributor. A second carbon member, which is not insulated, slides on the right cap of the shuttle and serves to conduct the current from the armature to the body of the magneto.

Path of High-Tension Current.

The high-tension current is collected from the collector ring by a brush carried in a brush holder, also supported by a removable cover, the low-tension grounding brush being retained by the same cover, which relieves the ball bearings of all current that might have a deteriorating effect. The cover also carries the safety gap, which protects the armature from excess of voltage should the magneto become disconnected from the spark plugs.

The distributor is attached directly above the armature and it consists of a shell, a rotating member

driven by steel and bronze gears from the armature shaft, and the distributing finger. The shell and rotating member are of the best insulating material. Imbedded in the shell are four contact plates which are in metallic contact with the lead terminals at the top of the distributor, into which the ends of the cables connected with the different engine cylinders are inserted and retained.

The high-tension current is collected from the collector ring by a brush and brush holder, and reaches the distributor from a carbon member through the bridge and another carbon. It is conducted to the brushes, placed at right angles to each other, which make contact alternately with the four contact plates in the distributor shell. In the operation of the magneto the circuit breaker ordinarily short circuits the low-tension winding of the armature, and this short circuit is only broken when the breaker opens. When the knurled screw member is wired to a metal portion of the car, the frame for example, the primary circuit is diverted, or the instrument short circuited, so that it will not create energy.

Variation in timing is obtained by turning or rocking the bell shaped magnets in the stationary base by means of the lever connections at the side lugs and in the same manner as the conventional breaker box is rotated. The spark is advanced by turning the magnet in the direction opposite to the rotation of the armature, and is retarded by turning it in the direction of the rotation of the armature. The range of timing obtained with all medium and large sized magnetos for three, four, six and eight-cylinder motors is 70 degrees, or very nearly the fifth of a circumference of a circle.

The magneto is mounted in a frame or base so that the entire construction may be turned or rotated partially on its axis. The installation is such that the instrument may be removed from the frame easily by displacing the top parts or clamps retaining the bearings. Not only is the design small and light, but all working parts are protected from water, dust, etc. The breaker construction is such that even at the highest speeds the lightness of the parts insures accurate operation, while the centrifugal force has no undue influence upon the circuit breaker, because the circuit is broken parallel to the axis.

Setting the Magneto.

At Fig. 92 A will be noted a circular indicator or timing window that is protected by glass, through which may be seen the numbers marked on the distributor gear. This is of value in that it permits the magneto to be positively set after it has been removed from the base, obviating the trouble of ascertaining the position of the distributor by opening the distributor case. The cables are all marked so as to make replacement a certainty.

The type A magnetos involve the same principle of advancing and retarding the magnetic field as the B and C, differing mechanically in that they have no separate base, but a stationary shell inside of which the magnet is turned when changing the timing by means of the lugs. The main features of the B and C types are retained. The two-cylinder instruments are similar to the A except that the metal part of the slip ring extends over about 100 degrees and that two collecting carbons are provided. Only one carbon is connected to the high-tension winding at a time and the current is alternately sent to one or the other cylinder.

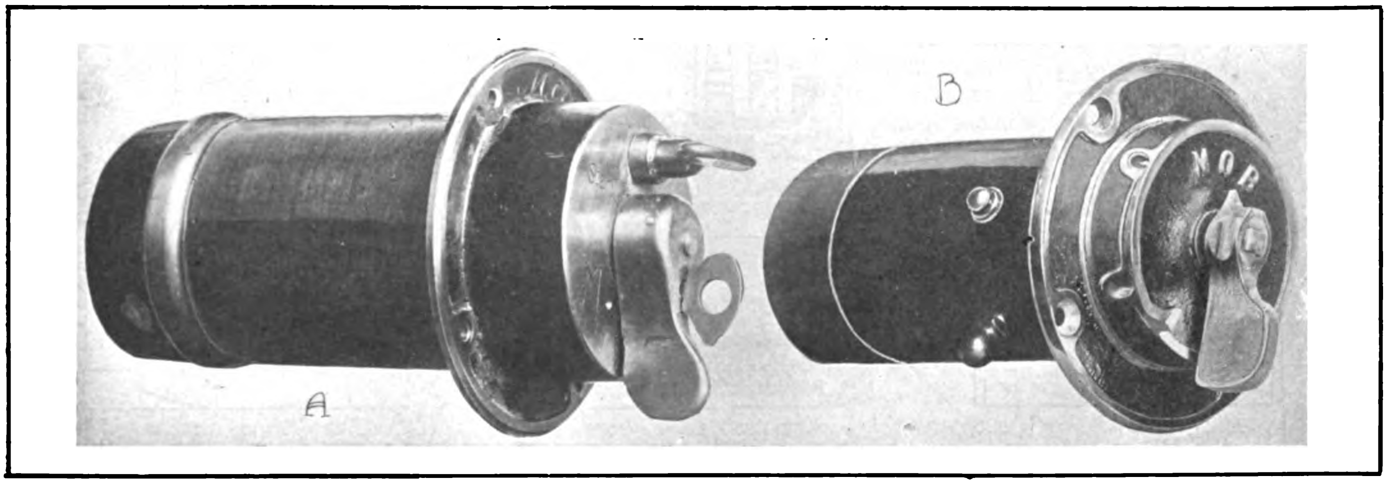


Fig. 91—Showing Dash Coils Utilized with Mea Dual Ignition: A, Type SS; B, Type SC.

As with all true high-tension magnetos, the wiring plan is very simple. In addition to the leads connecting the distributor with the spark plugs there is but one wire utilized, that employed for grounding the primary circuit or for stopping the operation of the motor.

Mea Dual Magneto Equipment.

The Mea dual magneto equipment, comprising a Mea magneto dynamo, coil and switch, does not differ in the main from the independent type. The system of connection required varies, however. The secondary or high-tension connections consist of wiring from the distributor to the spark plugs, in the same manner as with the independent type, and a connection from a high-tension switch to the magneto distributor, also one from this switch to the high-tension carbon holder. The primary wiring includes a connection from the magneto breaker to the switch utilized for grounding the magneto, and is identical with the wire used for this purpose with independent mag-

netos. There are also connections joining together the battery, coil and battery breaker of the magneto.

By means of these connections and the switch, the distributor is wired either to the magneto or to the high-tension side of the coil. Whenever the distributor is connected to the coil, the low-tension part of the switch grounds the breaker of the magneto, and closes the circuit to the battery breaker. When the distributor is connected to the magneto the switch disconnects the battery and opens the magneto ground connection. In this manner the distributor will be connected to the armature of the magneto when the instrument fires, and it is connected to the coil whenever the latter is operating.

Types of Coils Utilized.

The Mea dual equipments are supplied with a coil of the vibrator type which provides a number of sparks for every firing stroke of the motor. Designs are manufactured, however, with single-spark coils, and these may be fitted with the multiple-spark attachment. Both are of the horizontal dashboard type.

The dual magneto equipment differs only in the arrangement of the battery breaker. With the vibrator type of coil this breaker closes when the spark is desired, while with the single-spark type the breaker is normally closed and only opens at the instant of firing.

The Mea coil and switch of the vibrator type are shown at Fig. 91 B. All terminal posts are placed on the periphery of the coil close to the dashboard, and the vibrator is located at the end of the coil, where it can be reached easily when adjustments are necessary. The switch has three positions, these being "Battery", "Off" and "Magneto". No push button or special starting device is required. To start the motor from the seat the switch is moved to the battery position and then moved to the magneto side. The timing lever is always placed in a fully retarded position, in starting.

The single-spark type SS is shown at A. It comprises a mechanically actuated vibrator, by means of which a single spark or a number of sparks may be obtained as for starting from the seat. The system is operated by turning the lever to the battery position and moving slightly the starting device.

Timing the Magneto.

In timing the multiple magneto, place it in the position of its maximum advance by turning the magneto housing or timing lever in the direction opposite to that of the rotation of the armature. Remove the cover of the breaker box and turn the armature shaft in the direction of rotation until the figure 1 appears on the indicator and until the contact breaker opens. Turn the motor until the piston of the first cylinder (that nearest the radiator) is from .625 to .875 inch in advance of the dead centre. The secondary wires are attached according to the firing order of the motor and as explained in previous discussions on magnetos.

In installing magnetos on two-cylinder opposed motors, the instrument should be timed so that it will always fire on the terminal nearest the cylinder to be fired, as otherwise the wires will have to be crossed. This may be determined easily by opening one of the two covers and seeing with which high-tension carbon the metal segment is making contact.

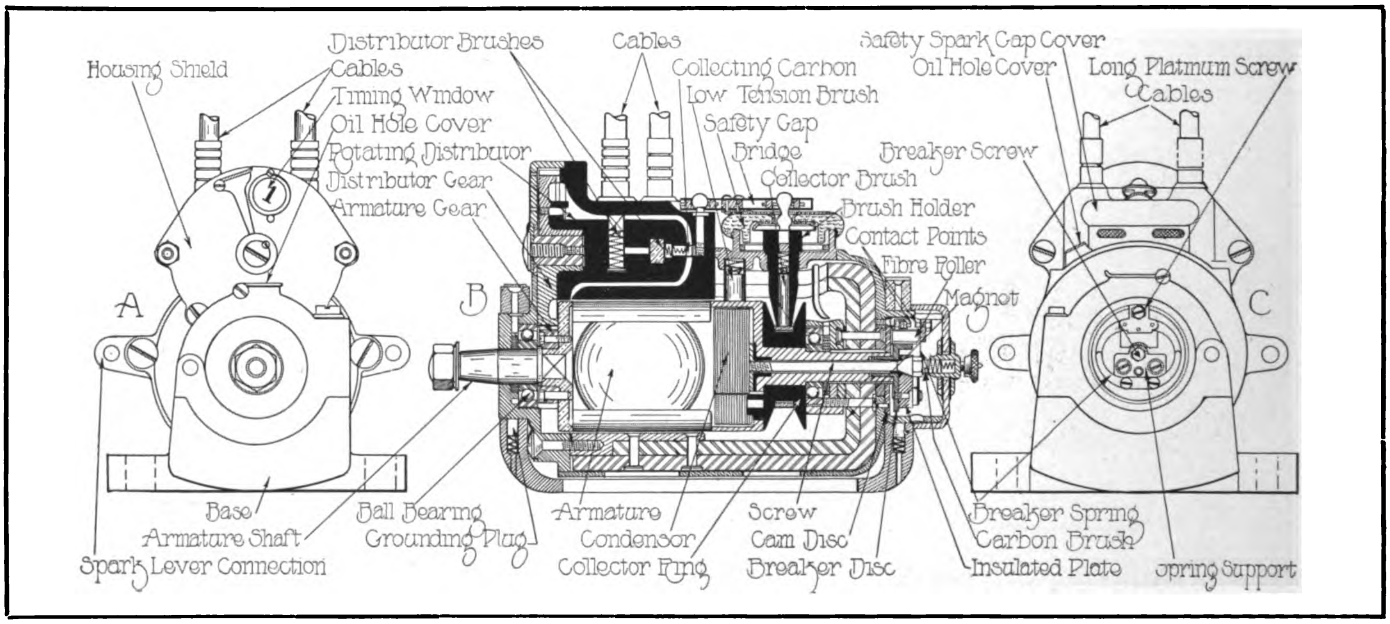


Fig. 92—The Mea Magneto Type BH4: A, the Driving End, Showing the Timing Window and Method of Oscillating Magnet; B, Sectional View; C, Breaker End.

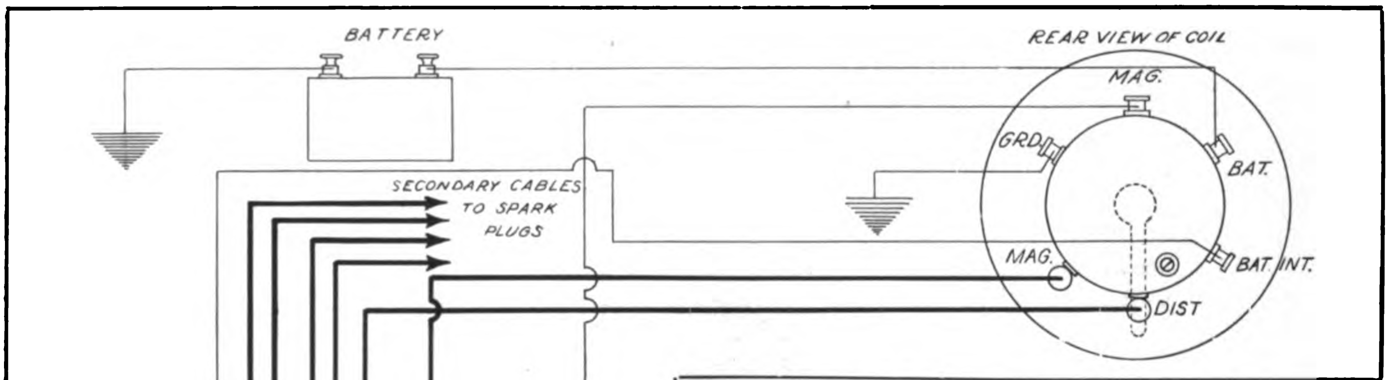
Replacing Magneto.

The resetting of the Mea, after it has been removed from a motor for cleaning or inspection, is simple. Before displacing the instrument, turn the motor or move the timing lever until one of the numbers appears on the indicator, then remove the magneto by opening up the base bearings and leave the engine undisturbed while the instrument is out of its base. In replacing see that the same number as before appears on the indicator. The identification of the cables is made easy by the number of rings on the hard rubber sleeves or terminals.

The opening of the platinum contact points should

be about .015625 inch, or slightly more, and the proper space is determined by the use of a wrench accompanying each instrument. The breaker may be removed from the box by loosening the long centre screw retaining the breaker to the armature, and screwing it into the small tapped hole provided in the breaker so that it may be used as a handle in lifting the breaker out. In replacing the breaker the small pin at its back must be introduced into the slot provided for it in the armature shaft and care must be taken not to tighten the screw until the pin is in its proper place.

The maker of the Mea recommends a spark plug gap of .015625 inch. The breaker must not be lubricated or the top cover supporting the high-tension carbon removed while the magneto is operating. This cover contains the safety spark gap, and if displaced



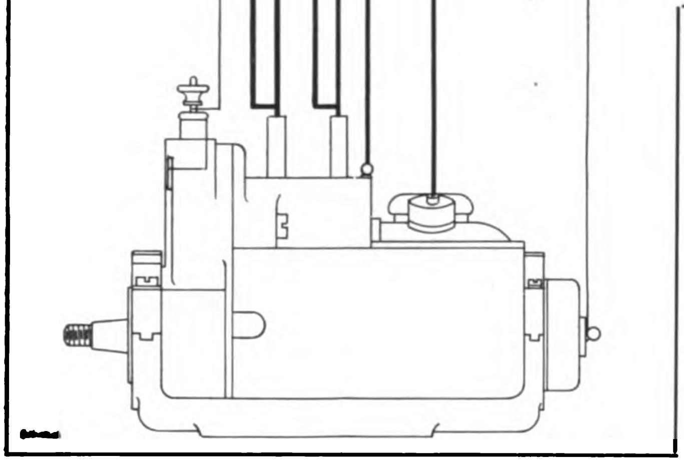


Fig. 93—Wiring Diagram of Mea Dual Magneto, Including Storage Battery and Dash Coil.

is likely to injure the winding of the armature. It requires no attention.

Timing Dual Equipment.

To time the dual equipment magneto the caps over the battery and magneto breakers are removed and the instrument fully retarded. The armature is then rotated until the figure 1 on the distributor gear is opposite the red line on the housing, and until the magneto breaker just begins to open. The motor is then turned to dead centre of the first cylinder, and if the engine is of the four-cylinder type, about 1.5 inches beyond, measuring on the circumference of the flywheel, or from .0625 to .09375-inch downward on the firing stroke. With six-cylinder motors it is preferable to time full retard slightly beyond dead centre.

CONTRACT DELIVERY SERVICE.

High Class Distribution at Minimum Expense Attractive to Business Men.

The practical saving that can be made by contract delivery, eliminating duplication of service and insuring satisfaction to customers, such as has been developed to a limited extent in a number of cities, is extremely attractive to business men, according to W. S. Pettit, sales manager of the Commerce Motor Car Company, Detroit, Mich., who maintains that considerable attention is being given to study of the possibilities of such contracting companies. Many small stores limit patronage because of lack of delivery facilities, and others cannot meet the demands that are made by customers through dependence upon express companies or messengers. Occasional deliveries are necessarily more expensive, and they are not systematically made.

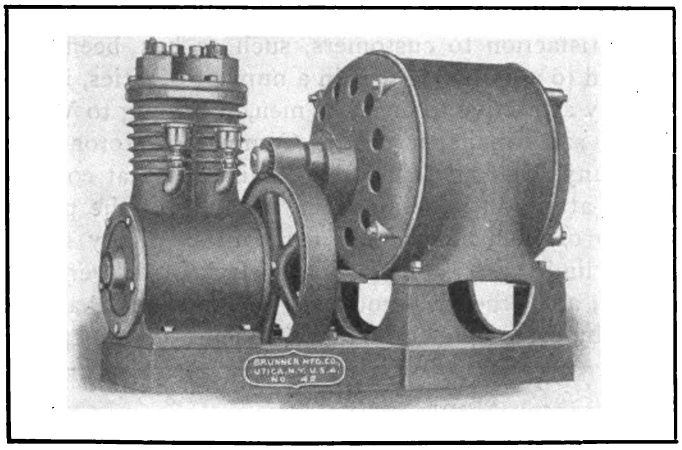
Inquiries made by some of the manufacturers indicate that a decided attention has been given the possibilities of organizing concerns for contracting with small stores, either by distributing from a central location where the goods are sent by the stores, or by collecting packages consigned to different localities by the vehicles covering the routes. The conclusion of those who have studied the problem in different localities is that a vehicle of 1000 pounds capacity, that can be fitted with a covered body that will carry bulky bundles, and equipped for convenient handling, will afford the best service in average conditions.

Economy of operation, speed and reliability are three important factors, and simplicity of construction and durability in service are absolutely essential. With businesses that will not support delivery equipment individually a contractor, by careful routing and good supervision, can combine a number so as to materially increase the satisfaction of the customers, extend the radius from which patronage is drawn and realize a reasonable profit.

The Mogul Motor Truck Company, Chicago, Ill., has appointed Charles Fisher, formerly with the Universal Motor Truck Company of Detroit, sales manager of the territory east of Chicago. He will have offices in New York City.

GARAGE AND SERVICE STATION EQUIPMENT.

MOTOR driven compressors are now considered standard equipment in the repair shop and service station, the design varying according to the service required. The Brunner Manufacturing Company, Utica, N. Y., is producing a number of different types, that shown in the accompanying illustration being adaptable to many varying classes of service. The complete outfit is self-retained and operates with so little vibration that it can be installed, if desired, without fastening to the floor.



Parker Double-Cylinder Motor Driven Air Compressor.

The No. 42 Parker outfit, as it is termed, comprises, in addition to the motor, a double-cylinder vertical compressor with cylinders having a bore of 1.825 inches and stroke of 2.5. The guaranteed pressure with a standard motor is 130 pounds to the square inch, although the compressor can be fitted for higher pressures upon order.

Lubrication is by the splash system and the motor bearings are oiled by ring oilers on the shaft. The height is 16.5 inches and the floor space required is 18.5 by 11 inches. The net weight is 170 pounds; shipping weight, 200.

Energy is supplied by a .5 horsepower electric motor, and drive is by a cast iron spur gear and a rawhide pinion. The compressor is driven at a speed of 350 revolutions a minute, and has a capacity of 4480 cubic inches (2.5 cubic feet) of free air a minute. The outlet is tapped for a .25-inch iron pipe. The finish is gloss black enamel. The motor is a direct current machine or single-phase alternating current, 110 or 220 volts. Motors of any frequency on alternating current are supplied at an extra cost.

The outfit can be made automatic with an electric controller and any desired pressure can be maintained day or night without any other attention than an occasional oiling. Two types of controllers are shown in an accompanying illustration, that at the left being designed for service with single or two-phase alternating current motors of two horsepower and less. The No. 91 is shown at the right and is similar to the other, but has a rheostat for all direct current motors and such alternating current motors as require starting resistance or a rheostat.

As previously stated, these controllers maintain a constant air pressure at all times and are stated to be extremely accurate and reliable. They can be adjusted for operation on a wide variation of pressure, or set to start and stop the motor within a variation in the tank pressure of two or three pounds, if desired. The construction is simple, only two diaphragms being used, these presenting such a small portion of their area to the pressure that they are practically wear proof. The contact points are of the wiping variety, insuring a clean surface at all times, and eliminating sparking.

The Brunner Manufacturing Company is issuing a new catalogue illustrating and describing air compressors, which will be mailed free.

MOVABLE LIGHT STAND.

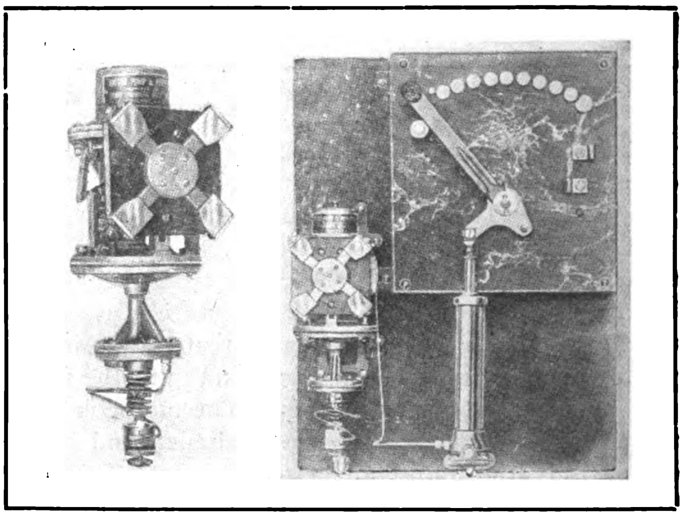
The Muller Manufacturing Company, East New Durham, N. J., has brought out a new light stand which is mounted on casters, permitting its use about the garage. A cluster of four bulbs is employed with a suitable reflector and the latter is adjustable. Sufficient length of lamp cord and a socket are supplied with each equipment, which is moderately priced.

GLYCO REINFORCED BEARING.

The Glyco bearing is being marketed by Joseph T. Ryerson & Son, Chicago, and it is claimed that by a bronze or steel reinforcement of skeleton construction the body and flange are greatly strengthened.

GENTER'S METALLIZED PAINT.

The J. H. Genter Company, Inc., Newburgh, N. Y., is marketing a metallized paint which is intended to withstand extreme high temperatures. It is stated that the three shades of copper will successfully survive a heat of 900 degrees Fahrenheit, and at the other



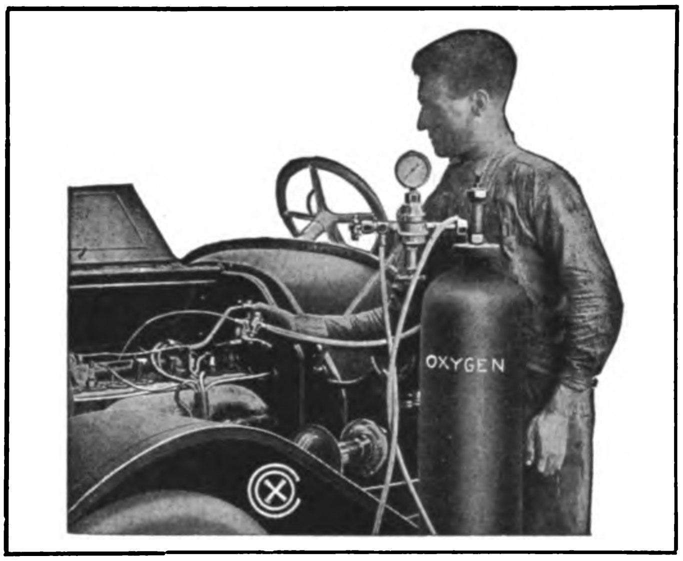
Electric Controllers Utilized with Parker Air Compressors.

end of the scale come black, brown and red, which, it is claimed, will remain unaffected under a heat of 2200 degrees.

COX OXYGEN CLEANER.

The introduction of the oxygen process for removing carbon from the cylinders of internal combustion motors has not only eliminated the necessity of pulling down the cylinders, but considerable labor is saved. Some of the advantages derived by the use of the new method are noted by the statement of a manufacturer who claims that the average four-cylinder engine can be cleaned in 30 minutes and a six-cylinder in 45. Another quality of the system is that deposits are removed from crevices, etc., not accessible with the scrapers.

The Cox Brass Manufacturing Company, Albany, N. Y., is marketing the Cox oxygen carbon cleaner, which equipment is shown in an accompanying illustration. It comprises a tank of oxygen with pressure



The Oxygen Carbon Cleaner Equipment Marketed by the Cox Brass Manufacturing Company, and Method of Use.

gauge, etc., and a flexible arm which is inserted through the spark plug opening of the cylinder. Means for controlling the flow of the mixture are provided, as shown in the illustration, and the oxygen consumes the carbon without affecting the metal. It is pointed out by the maker that a large number of motors may be cleaned during a week and that the cost is slight.

The equipment is constructed of high grade material, and high class workmanship characterizes all the products of this company, and each outfit is tested carefully before being shipped from the factory. The oxygen tanks are loaned, the only charge made being for the refill. The Cox oxygen carbon cleaner equipment is moderately priced and the maker has an interesting proposition for the trade.

HOYT FORD MAGNETO TESTER.

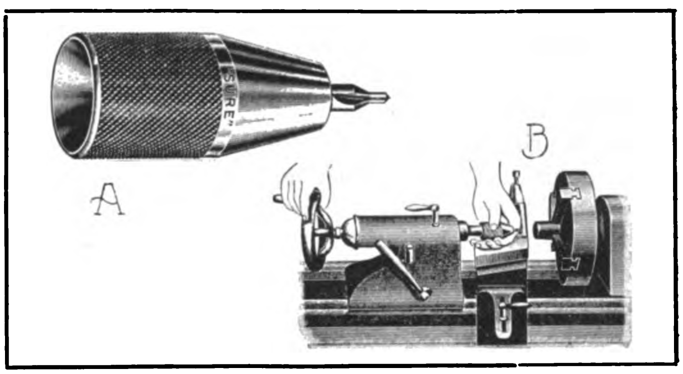
One of the most difficult troubles to locate with the model T Ford motor is the ignition, and many times weak magnets are the cause of the cylinder heating and lack of power. The Hoyt Electrical Works, Penacook, N. H., maker of current testing devices, is marketing the Hoyt Ford magneto tester, shown in an accompanying illustration. The meter is very compact, being 3.5 inches in diameter, and is constructed with the same care and high grade material for which the product of this concern is noted.

Hoyt Ford Magneto Tester.

The dial of the instrument is calibrated, providing three chief points, these being "Poor", "Medium" and "Good". The meter is fitted with two cables or leads and either may be utilized in connection with the magneto terminal. The remaining lead is grounded. The Hoyt Ford magneto tester is moderately priced and should prove especially useful to Ford service stations, repair shops and where a fleet of the Ford cars is maintained.

SURE CENTRE FINDER.

The West Haven Manufacturing Company, New Haven, Conn., is marketing the Sure centre finder, a new lathe tool, shown in an accompanying illustration. It has a socket that fits on the 60-degree angle taper of centre of the tail stock of the lathe, and when held in that position and fed up to the work held and revolving in the chuck, it immediately locates the centre. The friction of the centre finder on the lathe centre is sufficient to hold for drilling and countersinking, enabling the workman to make the three operations without change or use of any other tool. The fingers need do more than steady the tool. Each centre finder is sent out with a combination drill and countersink, which are stock sizes with any maker. The Nos. 0 and 1 have a short single-end drill and countersink about



West Haven Sure Centre Finder: A, Finder; B, Method of Use.

half the length of the double-end ones on the market, for the sake of compactness, but the double-end ones may be used, however.

HINTS FOR PROPER MAINTENANCE.

IN THE event of a broken crankshaft the usual method is to obtain a new one from the factory, but if the car is an old one and a new part cannot be secured it may be necessary to buy a drop forged crank in the rough and turn it up. Sometimes in the overhaul it is found that the crankpin is worn oval and will not yield to ordinary methods, and when such is the case a light cut is taken. The Strasburger Manufacturing Company, 326 Madison street, Chicago, is marketing combination lathe dogs, which are shown at Fig. 2, and these members are adjustable from two to six inches. They are designed for holding all kinds of crankshafts, such as utilized in automobile and marine engines, and other power plants, and can be employed wherever a common lathe dog can be used.

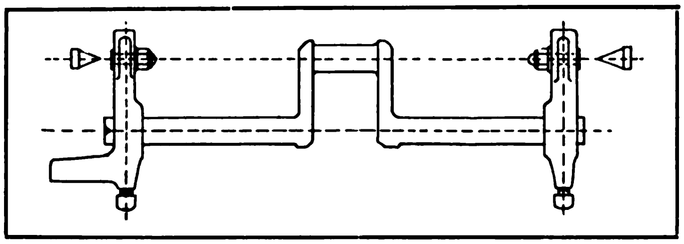


Fig. 1—Using Combination Lathe Dogs for Turning up the Crankshaft.

The design illustrated at C is adapted for turning heavy work, such as motor truck engine crankshafts, and is adjustable from two to eight inches. It is provided with screw feed centre and gauge, and each type of dog is constructed of the best malleable iron with case hardened steel screws.

The company points out that the turning up of a crankshaft has always been accomplished under certain difficulties except in shops where they are made in large numbers, and where special machines are required. As crankshafts are now forged in nearly all sizes and forms, and may be procured at a reasonable cost in the rough, it is possible to turn these up in the lathe by the following process:

Assuming that a four-throw crankshaft is to be finished, although single and double ones are more common to the repairman: The first step is to centre the work, either by laying off and centring in the drill press or in the lathe with the use of a steady rest. The driving dog is fastened at one end and the work placed between centres.

The bearings, front, centre and rear, are roughened down to within .03125 or .0625 inch of the finished size. The straight or tailless dog is then fastened on the other end and one-half of the stroke is measured from the centre of the crank to the centre hole in the adjustable screws, and the nuts securely tightened. The work is then placed between the adjustable centres and lined up parallel by running the lathe carriage back and forth.

The second and third pins should be roughened down to within .03125 or .0625 inch of the finished size. The dogs should now be loosened and the crank given half a turn, the first and fourth pins lined up parallel, and finished to exact size. After this is done the dogs are again loosened and the crank given half a turn back and lined up parallel to finish the second and third pins to exact size.

The four pins are now finished to size, so the straight dog and the counter-balance should be taken off, and the crank placed between centres. The centre bearing is then finished to size and the steady rest applied, while the front and rear bearings are being finished to size. Care should be taken not to have the tailstock centre too tight during the finishing cuts.

The large face plate should be used for this operation and a weight clamped to it for a counter-balance. If the crank should have a flange on one end, it may be chucked and a four-jaw chuck used instead of the face-plate, then only one dog will be necessary. If a heavy cut be desired or the tool chatter, the steady rest can be used on one pin, while the other pin is being turned down.

BUILDING UP BEARINGS.

The following suggestion is made by a workman, for adjusting the small ends of connecting rods where considerable play exists: Press the bushing out of position in the vise and sweat a layer of solder onto the outside surface. After pressing the part into position again it will be found to be smaller than before and the wristpin can be refitted.

SOFTENING CAST IRON.

To soften cast iron for drilling, heat the part to a cherry red, and have it lie level in the fire. Then with the tongs put on a piece of brimstone, a little smaller in size than the hole to be drilled. This softens the iron entirely through. Let the piece remain in the fire until cooled.

The following suggestion for eliminating cotter pins and preventing nuts from working loose on the spring clips, brake drums, etc., is contributed by a driver: Make a saw cut in the bolt, screw up the nut, then spread the bolt with a chisel.

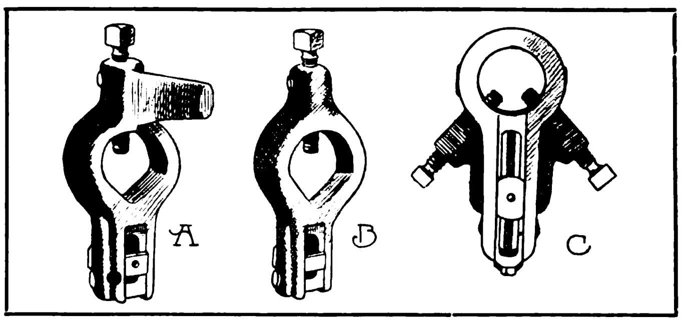


Fig. 2—A and B, Adjustable Combination Lathe Dogs; C, Design for Heavy Work.

"LOGGING" NEAR THE METROPOLIS.

Five-Ton G. M. C. Truck Hauling Timber Cleared from New Yorker's Big Estate.

Those who have occasion to speak of New York City regard it as further removed than all cities of the nation from industries associated with the country, and, in some instances, with what might be termed the wilderness of civilization. New York is a city of enormous proportions and the municipality itself contains more people than any single state aside from New York State itself, and when the commuters from the suburbs—for practically every city, town and village within 50 miles is so regarded—and the half million daily visitors are considered, it will be understood that there is within the radius stated a population hardly conceivable.

New York City itself is in a state of transition, and to the critical visitor this aspect is always emphasized by the building operations, but aside from construction one might assume there was little else than commerce and manufacturing to employ the multitude of inhabitants. But, strange as it may appear within comparatively short distances of the commercial centre of New York City, which is generally spoken of as Broadway, there are men engaged in work that might be associated with the mountains or the remote country. This fact is emphasized by the recent purchase of a five-ton G. M. C. truck by George B. Tompkins, who has a very large estate, that can be reached in less than 45 minutes from Grand Central terminal, who is using it in hauling timber that he is cutting in clearing his property, as he is delivering logs of large size to New York lumber dealers. The logs are cut on the estate and are hauled with a trailer to different points where they are shipped or stored for use later on. The high price of timber makes the sale of the logs extremely profitable, and the truck, which is doing work that was done by eight horses, is regarded as a very satisfactory investment.

Five-Ton G. M. C. Truck Hauling Timber with a Trailer from the Estate of a New York Man 45 Minutes from Broadway, New York City.

INTERNATIONAL GETS MORE TIME.

Extension of Notes and Loans for Three Years and Other Creditors Preferred.

The temporary injunction obtained by minority stockholders of the International Motor Company to permit an inquiry into the proposal of the company to place a mortgage of $1,200,000 on its property, pending determination of the proposition judicially, and with the possible object of bringing about a receivership, has been dissolved by Judge Garretson of the New York supreme court, and the company will now make effective a plan evolved for the purpose of strengthening it financially.

The details of the plan have been worked out and comprehend that all the bank loans and notes payable, which aggregate $2,500,000, have been extended, both principal and interest, for three years from Nov. 1, 1913. These obligations have been subordinated to the claims of the merchandise creditors, who will have prior claim on the assets of the company save for a mortgage of $48,000 on the plant at Plainfield, N. J., which remained when the property was acquired from the Saurer Motor Company, and a mortgage of $6500 on Newark, N. J., real estate, which remained when this realty was bought as a service station for the company.

In other words, indebtedness aggregating $2,500,000 has been deferred three years and the merchandise creditors will have first claim on the assets after mortgages aggregating $54,500 have been satisfied. The claim of the company is that the assets, exclusive of licenses, patent rights, good will, etc., amount to more than $5,000,000, and that the claims of the merchandise creditors are approximately $300,000.

George E. Blakeslee, the petitioner, maintains that his suit for the dissolution of the company will be continued to a finality.

C. J. Rohrer of the General Electric Company, Schenectady, N. Y., will read a paper on "Small Motor Applications for Farm Work" at the seventh annual convention of the American Society of Agricultural Engineers, to be held at the Great Northern hotel, Chicago, Ill., Dec. 29-31. Part of the session will be devoted to the consideration of various types of motor farming apparatus.

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